

STATE OF NEW YORK
DEPARTMENT OF FARMS AND MARKETS

BERNE A. PYRKE, Commissioner

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The Gipsy Moth

An Imminent Menace to the Forest and
Shade Trees of the State of New York

Present status of the Gipsy Moth situation and discussions
at a conference held in Albany, November 16, 1922

also

Copy of Resolutions Adopted in Relation to European Corn Borer

Compiled by
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CONTENTS

	PAGE
Foreword	5
History of the Gipsy Moth, Dr. E. P. Felt	7
Report of Conference on Gipsy Moth:	
Representatives at Conference	25
Address, Dr. E. P. Felt	27
Discussions:	
Charles O. Bailey	30
A. F. Burgess	32
W. A. Osgood	41
Harold L. Bailey	42
Dr. W. E. Britton	44
R. A. Sheals	46
Dr. T. J. Headlee	46
Leonard S. McLaine	48
C. R. Pettis	50
Dr. C. L. Marlatt	52
Dr. E. D. Ball	55
Resolutions	56
Memorandum Regarding Establishment of Immune Zone	57
Resolutions on European Corn Borer	58

ILLUSTRATIONS

	PAGE
Colored Plate Showing Different State of Gipsy-Moth Development	7
Fig. 1. Dead and Defoliated Woodland Resulting from an Attack of Gipsy Moth	59
Fig. 2. Band of Sticky Material on Tree Trunk	60
Fig. 3. Applying Tree-banding Material to Protect Foliage from Gipsy-Moth Caterpillars	61
Fig. 4. Spraying Trees 85 Feet High with High-power Sprayer	62
Fig. 5. Outline Map Indicating Proposed Immune Zone	63

FOREWORD

This bulletin gives a summary discussion of the more important facts in relation to the gipsy moth problem, and on this account necessarily includes data and plans considered at a conference on the gipsy moth and European corn borer held in the office of the Commissioner of Farms and Markets, Albany, Thursday, November 16, 1922, and appearing as an appendix of this publication.

New York State is confronted with a serious problem. The discussions and conclusions presented in this bulletin and in somewhat more detail in the account of the recent conference, represent the best judgment of a group of experts from Washington, D. C., the New England States, New Jersey, and Canada, all of whom are exceptionally qualified by training and experience to pass on the numerous complex questions involved.

The conferees outlined a constructive program which should receive the most careful consideration by all interested in the welfare of the state, and in connection therewith attention is called to decisions as outlined in this bulletin. The information is being made generally available that it may serve as a guide in determining our future policy in relation to this insect.



GIPSY MOTH

Different stages from egg cluster to adult moth. Natural color and size, except eggs magnified (2).



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HISTORY OF THE GIPSY MOTH

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The gipsy moth (*Porthetria dispar* Linn.), a serious enemy of forest trees in Europe, was brought to Medford, Massachusetts in 1868 or 1869. About twenty years later it was so abundant and injurious that the legislature of Massachusetts appointed a special commission to study the situation. This commission began operations in 1890 and a program of extermination was recommended. Work on a larger scale was started by the State Board of Agriculture in 1891, which was continued until 1900 and then abandoned, largely because the insect was so thoroughly controlled that few realized the destructive possibilities of the insect.¹

At the end of a five-year period conditions in the infested area had become so serious that a program of control was undertaken and has been continued to the present. The infested states were primarily concerned with local control; the Federal Government, entering the field in 1906, devoted its energies largely to checking the spread of the insect into uninfested territory.

The importance of scientific investigations for the purpose of determining the most effective methods of dealing with the situation was realized early. These became even more desirable with the abandonment of the attempt to exterminate the insect, and throughout the period there has been the closest possible cooperation between those concerned primarily with investigations and the larger group charged with the execution of repressive measures.

ECONOMIC STATUS IN AMERICA

The status of this insect as a pest can not be scrutinized too closely, because the advisability of any plan must be determined in large measure by the benefits likely to be obtained from its adoption. The fact that nearly twenty million dollars have been spent in the New England and adjacent states in efforts to exterminate and control the insect — mostly the latter — gives a concrete idea of the rank of this insect as a pest. The total expenditures in Massachusetts in 1921 for control of the gipsy moth in the then infested area — probably less than three-fourths of the total area of the state — amount to the tremendous sum of \$836,108.40, according to figures compiled under the direction of the Massachusetts State Forester, William A. L. Bazeley, and kindly placed at our disposal. The state of Connecticut has had a gipsy moth problem since 1906, and in 1921 expended approximately \$1000 per infested town for control work, and this in an area where

¹ 1901, Rep't St. Bd. Agr. (Mass.) on Gipsy Moth, House, No. 204, pp. 9-16.

gipsy moth was not allowed to become abundant. It should be emphasized that these expenditures in both Massachusetts and Connecticut are mostly for repressive or control work and do not include expenditures by the general government for the prevention of spread.

There are, in addition to the above, the direct losses caused by this insect in areas where it was abundant. Unfortunately, it is impossible to estimate these with a reasonable degree of accuracy. The general tendency is greatly to minimize them, because defoliation by an early summer feeding caterpillar is evident for only a few weeks, and the new growth of leaves or the development of sprouts frequently hide really serious injury. There are records showing that in selected areas throughout the infested territory 26 per cent of the red oak trees are dying or have died during the past ten years. Conservation Commissioner Bazeley of Massachusetts is authority for the statement that in the oak forests on Cape Cod, which have been the hardest hit by the gipsy moth, 90 per cent of the oaks are dead, the oaks representing 75 per cent of the forest land. It is well known that many pines in mixed growth have been killed by gipsy moth stripping. It is also a fact that injury to hard woods by gipsy moth may produce conditions favorable to serious damage by borers.

The killing of trees by no means represents the total injury to the forest. There is a very material retardation in growth, which means an actual loss in the production of wood. Definite figures are almost impossible because the retardation in growth varies from season to season. It seems probable that a general woodland infestation by gipsy moth under present conditions would practically prevent the growth of oaks and other favored food plants for the production of lumber. It would appear that much of the infested hard wood areas in New England under present conditions can not be relied on to produce anything more valuable than cordwood and even this in much less than normal amounts.

There is in addition to the forest losses just mentioned, the very material damage to shade and street trees in spite of general control measures recommended and enforced by state laws. Here again definite figures are not obtainable. There is furthermore presumably equally great and possibly greater losses following injuries to lawn trees, orchards, and other trees not ordinarily comprehended in forest areas.

EUROPEAN STATUS

The gipsy moth occurs in the whole of central and southern Europe, flourishing in the temperate regions and ranging across temperate Asia to Japan. It occurs as far south as Algeria and is not common in England. It is considered an injurious insect of first importance in portions of France, Germany, and Russia, according to Doctor Howard. In the protected forests of these

countries its ravages are occasionally excessive, while at frequent intervals the shade trees of the larger cities are completely stripped of their leaves. Few European insects have received more attention from European foresters than this species.

DISTRIBUTION IN AMERICA

The gipsy moth is generally distributed over a very considerable percentage of the New England States. It occupies most of the southern third of Maine, excepting a little of the extreme eastern portion, the southern three-fourths of New Hampshire, and occurs equally far north in Vermont, though the area west of the Connecticut River has an average width of but twenty-five miles and extends along the southern tier of towns to the New York line. The pest occurs adjacent to our border from southern Vermont across the western extremity of Massachusetts to and including the northwestern township of Salisbury, Connecticut. The border of the infested territory then extends in a roughly southeasterly direction to East Lyme on the Sound. There has been a considerable extension of the infested area in the past two years, consequently a rather wide strip along the border is lightly infested. The spread from the Connecticut River to the western boundary of Massachusetts has occurred in the past two seasons and a similar spread into New York State may be expected within a year or two, unless the insect is checked by well directed and thorough control measures.

There have been a number of infestations outside of the area defined above, some of which are still in existence. A rather serious infestation was found at Geneva, New York. This has been exterminated. A more general and in some respects a more difficult one to control was found at Mount Kisco, Westchester County, and this likewise has been cleaned up. There was also an infestation at Garrison, Putnam County, which appears to have been exterminated. A small infestation was found in Prospect Park, Brooklyn, and exterminated. There is a somewhat widespread infestation in Patchogue and vicinity on Long Island and also at Greenport. These latter are being treated in the same way as the earlier infestations and should be cleaned up shortly.

A small infestation discovered in Cleveland, Ohio, was quickly exterminated.

A large and general infestation, originating directly from Europe, was discovered in 1920 in New Jersey. Through the vigorous action of the Federal Government and the authorities of that state, it has been so greatly reduced that it is approaching extermination.

The occurrence of outlying or remote infestations, such as those indicated above, is to be expected. Experience during recent years has repeatedly demonstrated the practicability and the economy of actually exterminating the insect under such conditions.

DESCRIPTION

The successful control of this insect is dependent to a very considerable degree upon the early detection of the pest in a locality; consequently careful descriptions and excellent illustrations are of great service in enlisting the cooperation of all interested in preventing damage by this forest pest. The gipsy moth is most likely to be found adjacent to areas known to be infested, though experience shows that it may occasionally become established at some distance or in a remote locality, the latter generally through the shipment of materials bearing egg masses, such as timbers, stone, and especially young trees or other plants originating in or grown in sections where the insect is numerous.

Gipsy moth eggs occur from midsummer to the following spring, and the oval, rather flattish masses, frequently measuring an inch or more in diameter, appear very much like a small section of sponge. The egg masses are usually found on bark, and are covered with buff-colored scales from the underside of the female's abdomen. They also occur on stones, in tin cans, and in fact on or in almost any object near at hand, not excluding leaves of various plants. They are very likely to be found on the under surface of limbs, fence railings, moldings, cornices, etc., since the caterpillars usually seek a somewhat sheltered position before transforming to pupae, and the females rarely crawl far before depositing their eggs.

The nearly globular, pale yellowish or salmon-colored eggs are about $1/20$ of an inch in diameter and some 400 to 500 occur in an egg mass, though occasionally a cluster may contain 1000.

The full-grown caterpillar is from about 2 to $2\frac{1}{2}$ inches long and may be recognized by the double row of conspicuous warts or tubercles down its back, the eight anterior being blue — not counting the four blue ones just behind the head — and the remaining twelve red. Similar tubercles also occur on the sides, and there is a marked clothing of hairs — these latter forming nearly equidistant, diverging bunches most readily seen on the sides, and with a length about equal to the diameter of the body. There is a prominent hairy tubercle on either side of the segment next the head which gives the caterpillar, especially in its early stages, a peculiar, broad-headed appearance. The young caterpillar is slightly over $1/10$ of an inch long just after it issues from the egg. It has a black head, the body being brownish yellow and well clothed with long hairs.

The somewhat conical, dark-brown pupa ranges from $3/4$ to $1\frac{1}{2}$ inches in length and is usually found in numbers lying among a few silken threads and securely attached thereto by its terminal spines. The pupa is ornamented with a few very scattering golden-yellow, slightly curled hairs, which are somewhat characteristic.

The male moth is a slender, free flying, olive-brown, black marked insect with featherlike antennae and a wing spread of about $1\frac{1}{2}$ inches.

The female is much heavier, lighter colored, and does not fly, though she has a wing spread of about 2 inches. The color is white or buff white with more or less distinct black markings on the the wings. The abdomen is tipped with black.

LIFE HISTORY

The winter is passed in an egg mass remarkably resistant to atmospheric and other changes, though recent investigations have shown that minus 20° F. is fatal to exposed egg masses. This does not apply to those within the shelter of tree trunks or covered by snow; consequently it is presumably possible for the insect to exist in injurious numbers in the Adirondacks.

The caterpillars feed early in May to about the middle of June, some nine to eleven weeks being required to complete growth and enter the pupal stage. The recently hatched caterpillars remain on the egg clusters from one to five or more days and then commence feeding on the leaf hairs. They soon eat small holes in the foliage, and, after the third or fourth molt, about as many feed on the edge of the leaf as eat holes. There are five or six molts before full growth is attained. The caterpillars are largely nocturnal in habit, remaining in clusters on limb or trunk or hiding in some crevice during the day, beginning between seven and eight o'clock in the evening, leisurely to ascend the tree where they feed on the foliage at intervals during the night, descending about three o'clock in the morning. This clustering habit is similar to that of our native forest tent caterpillar, *Malacosoma disstria* Hubn.

The caterpillars transform to pupae late in June or early in July, moths appearing from the early to the latter part of July, belated individuals occasionally being found in September. The males emerge in advance, and shortly after the females appear, pairing takes place and eggs are laid. The embryos or very young caterpillars are frequently well developed within the eggs in two or three weeks after oviposition, and as a rule they do not emerge until the following spring. There are records of eggs hatching in early September, though the life-cycle was not completed.

MEANS OF SPREAD

This matter is one of great importance in all control or repressive work. Fortunately the female gipsy moth does not fly; consequently the spread of this pest is ordinarily slow, because it must rely for dissemination on the crawling abilities of the caterpillars, on being carried by other agents, and on the distribution of eggs.

The crawling of caterpillars in various stages is comparatively limited, and ordinarily does not result in a wide distribution of the pest, although there is danger of a number of caterpillars crawling onto or falling upon a vehicle, such as an automobile, and being carried a considerable distance. This method of distribution is restricted to a comparatively short part of the season; and in estimating its effectiveness, allowance must be made for

the fact that a few caterpillars in an uninfested section must successfully withstand a number of natural hazards before the insect becomes established. This latter factor has presumably been important in preventing the establishment of the insect in a number of localities. Danger of spread through caterpillars being carried by vehicles may be greatly lessened by keeping the trees along highways and other public places free from serious infestation.

Investigations conducted in recent years have shown that, under favorable conditions, newly hatched caterpillars may be carried by the wind for considerable distances—twenty miles or more. It has been determined that the temperature must be above 65° F. and the wind velocity eight miles or more, if there is to be an appreciable distribution in this manner. This wind spread is one of the difficult problems, and it must be taken into consideration when making plans for control work. It is this factor that has presumably been responsible for the relatively rapid westward spread during the last few years. Effective wind spread is more likely to occur in thickly infested areas, especially if these be on elevations. It follows that wind spread can be checked to a considerable extent by preventing serious infestations in areas near the boundary of the infestation.

The widespread, isolated infestations, such as those mentioned above occur almost entirely by the transportation of trees, stones, and other material bearing gipsy moth egg masses. There have been systematic and largely successful efforts toward preventing spread in this manner. A system of inspection and notification has prevented the shipment of infested trees and other materials to a very large extent. This work is in charge of federal and state agents, the two cooperating with each other most effectively.

FOOD PLANTS

Gipsy moth caterpillars, when abundant, may be found on a very large proportion of the trees and shrubs. Experience shows that they thrive best on apple, oak, birch, willow, poplar (aspen), beech, and larch, listing the trees in the approximate order of their importance, and that after the caterpillars have passed the earlier larval stages, they also thrive on pine, spruce, hemlock, and chestnut. It should be noted that trees in the first list must be present if those in the second are seriously injured, since the young caterpillars can not live on the latter. Furthermore, the elms, maples, and hickories are not particularly favored by the caterpillars and consequently not likely to be seriously injured unless growing in the near vicinity of the more favored food plants of the first-named list. It is unfortunate that the favored food plants comprise most of our more important forest trees, and while the problem is a difficult one, it is not impossible to avoid considerable injury by the judicious elimination of favored trees.

The importance of food preferences in the control of gipsy moth is so great that we are giving below the results of extended studies by Mr. F. H. Mosher on the food plants of this pest:

Class I

Species that are favored food for gipsy moth caterpillars; that is, they develop readily and in large numbers from egg to adult.

Alder, Speckled	Oak, Dwarf Chestnut
Apple	Oak, Bur
Ash, Mountain	Oak, Pin
Aspen, American	Oak, Post
Aspen, Large-toothed	Oak, Red
Balm-of-Gilead	Oak, Scarlet
Beech, American	Oak, Bear
Birch, Gray	Oak, Shingle
Birch, Paper	Oak, Swamp White
Birch, Red	Oak, White
Blueberry (<i>V. angustifolium</i>)	Poplar, Lombardy
Box Elder	Rose, Pasture
Gum, Red	Spruce, Blue
Hawthorn	Service-berry
Hazelnut	Sumac, Mountain
Hazelnut, Beaked	Sumac, Scarlet
Larch, American	Sumac, Staghorn
Larch, European	Willow, White
Linden, American	Willow, Glaucous
Linden, European	Willow, Sandbar
Oak, Black	Witch-hazel
Oak, Rock Chestnut	

Class II

Species that are favored food for gypsy moth larvae after the earlier caterpillar stages; that is, the very young caterpillars are unable to develop successfully on these trees, consequently pure plantings are rarely injured.

Chestnut	Pine, White
Hemlock	Plum, Beach
Pine, Pitch	Spruce, Black
Pine, Red	Spruce, Norway
Pine, Scotch	Spruce, Red
Pine, Jack	Spruce, White
Pine, Western White	

Class III

Trees that are not particularly favored, but on which a small proportion of gipsy moth caterpillars may develop.

Barberry, European	Fern, Sweet
Bayberry	Gale, Sweet
Birch, Black	Gum, Black
Birch, Yellow	Hickory, Bitternut
Blueberry, Low	Hickory, Mockernut
Blueberry, Tall	Hickory, Pignut
Cherry, Sweet	Hickory, Shagbark
Cherry, Wild Black	Hornbeam, American
Cherry, Wild Red	Hop Hornbeam
Chokeberry	Maple, Norway
Choke Cherry	Maple, Red
Cottonwood	Maple, Silver
Cranberry, American	Maple, Sugar
Elm, American	Pear
Elm, European	Poplar, Silver
Elm, Slippery	Sassafras

Class IV

Species that are not favored food for gipsy moth caterpillars, and on which the pests ordinarily occur in very small numbers.

Arbor Vitae	Huckleberry, Highbush
Arrowwood	Inkberry
Arrowwood, Maple-leaved	Ivy, Poison
Ash, Black	Juniper, Common
Ash, Blue	Kentucky Coffee-tree
Ash, Red	Laurel, Mountain
Ash, White	Laurel, Sheep
Azalea, White and Flame	Locust, Black
Balsam, Fir	Locust, Honey
Blackberry, High	Maple, Mountain
Blue-flag, Larger	Maple, Striped
Butternut	Mulberry, Red
Catalpa, Hardy	Mulberry, White
Cedar, Red	Osage Orange
Cedar, Southern White	Osier, Red
Cornus	Pepperbush
Cranberry-tree	Persimmon
Currant, Red	Privet
Cypress, Bald	Raspberry
Dangleberry	Sarsaparilla
Dock, Narrow	Skunk Cabbage
Dogwood, Flowering	Spice-bush
Elder, American	Sweetbrier
Eubotrys, Swamp	Sweet Pepper-bush
Feverbush	Sycamore
Grape	Tea, Appalachian
Greenbrier	Tulip-tree
Hackberry	Viburnum, Sweet
Hardhack, Pink	Walnut, Black
Hardhack, White	Willow, Bay-leaved
Holly, American White	Winterberry, Smooth
Honeysuckle, Bush	

LAWS

The successful control of gipsy moth is impossible without adequate laws. The state of Massachusetts,¹ as might be expected on account of its longer and more costly experience, has enacted the most comprehensive provisions declaring both the gipsy and brown tail moths in their various stages to be public nuisances, and providing penalties for the transportation of the insects in any of their stages, and for the appointment of an executive officer with wide discretionary powers. Earlier acts provided for exterminative work at state expense, while present laws make elaborate provisions for control largely at local expense (the total not to exceed a specified percentage of the assessed valuation); for limited state aid in excess of such amounts; and authorize the inclusion under certain conditions of the elm-leaf beetle or any other tree- or shrub-destroying pest.

The laws of the states of Maine (Ch. 29, Laws of 1907), New Hampshire (Ch. 147, Laws of 1907), Rhode Island (Ch. 242, Laws

¹ See Acts of 1890, Ch. 95; Acts of 1891, Ch. 210; Acts of 1905, Ch. 381; Acts of 1906, Ch. 268; Acts of 1907, Ch. 521; Acts of 1908, Ch. 591; Acts of 1909, Ch. 263, 452; Acts of 1910, Ch. 150, and Ch. 132 of the General Laws of Massachusetts, 1921.

of 1908) and Connecticut (Ch. 114, Laws of 1907 and Ch. 267, Laws of 1915) all declare the gipsy moth in its various stages a public nuisance, and provide penalties for the transportation of the pest to uninfested areas. The laws of Maine, New Hampshire, Rhode Island and Connecticut provide for control at local expense with a certain amount of state aid.

NATURAL ENEMIES

The control of injurious insects by natural agents is a logical method and is advisable whenever possible. Early observations in Massachusetts showed that about a dozen native song birds feed on gipsy moth caterpillars, the most useful being the yellow-and-black billed cuckoo, Baltimore oriole, cat bird, chickadee, blue jay, chipping sparrow, robin, red-eyed and yellow-throated vireos, and the crow. Unfortunately, birds are not equal to the task of controlling this pest under present conditions.

An effort was made in 1905 by the state of Massachusetts in cooperation with the Federal Bureau of Entomology to introduce parasites and other natural enemies from Europe and Japan. This work has been followed up systematically, and a number of species have been successfully established in this country, some being reared in numbers and liberated under the most favorable conditions possible.

The large Calosoma beetle, *Calosoma sycophanta* Linn. has become well established in eastern Massachusetts and is undoubtedly destroying many larvae and pupae. Several of these beetles were found in Albany a few years ago.

Among the more important of the introduced parasites are two Tachinid flies, *Blepharipa scutellata* R. D. and *Compsilura concinnata* Meig. The latter is also a parasite of the brown-tail moth and of many of our native injurious caterpillars. There are also two minute, four-winged, wasplike parasites, *Apanteles melanoscelus* Ratz., and *Apanteles lacteicolor* Vier. The latter, like *Compsilura*, is also a brown-tail moth parasite. In addition to the above introduced parasites of the gipsy moth, there are two tiny egg parasites, *Schedius kuvanae* How., which was brought from Japan, and the European *Anastatus bifasciatus* Fonsc.

The work of the natural enemies mentioned above and the wilt disease have served greatly to reduce the numbers of the gipsy moth in many badly infested localities, particularly in the oldest infested sections.

It is impossible to forecast the outcome of these introductions. It is known that certain of the above-named species are widely distributed in eastern New England, and under some conditions appear to be rendering valuable assistance. It would be unwise to depend on them until they have demonstrated their ability to control this pest beyond any reasonable question; otherwise we may suffer great and unnecessary losses.

CONTROL MEASURES

Thirty years of fighting this insect in New England have developed methods and demonstrated possibilities that are of great service in handling this problem, and New York State can do no better than to utilize these as far as they are applicable to our conditions. The work in New England during recent years has been devoted largely to preventing excessive injury in older infested regions and to checking or delaying spread into new territory. Suppressive work in earlier years was prevalent in woodlands as well as in other areas. In connection therewith, there have been most important developments in improving spraying apparatus, and there is a possibility that even greater efficiency may be attained in the future. It is sufficient to note that at the present time spraying or direct control work in what may be called the normal woodland areas of New England is not being carried on to any great extent, largely because of the enormous expense in proportion to the value of the wood and timber. This does not apply to the large, semi-wild areas, such as the Middlesex Fells where park or near-park conditions justify much larger expenditures than would be warranted in ordinary rural districts.

Spraying. Spraying with arsenate of lead, using the paste at the rate of 10 pounds to 100 gallons of water, or 5 pounds of powder thoroughly applied to the foliage, preferably just after the young caterpillars have commenced feeding, gives excellent results. Considerable dependence has been placed upon thorough spraying of this character for exterminating isolated infestations. An effective horse-drawn outfit is a high-power sprayer equipped with a ten horse-power gasoline engine and a triplex pump capable of delivering 35 gallons of liquid per minute at a pressure from 225 to 350 pounds. The engine and pump, together with a 400 gallon tank, can be mounted on a well-built wagon. A more efficient outfit, having higher power and capable of greater working pressure, can be mounted on a motor truck. A one-inch hose of superior quality is used, and by increasing the pressure at the machine, the spray can be conducted through several thousand feet of hose, if necessary, without greatly reducing the nozzle pressure, which latter should be maintained at about 225 pounds. A solid stream spray delivered through a Worthley nozzle is usually employed, and with this equipment it is possible rapidly and thoroughly to spray even the tallest trees from the ground.

Creosoting. One of the best methods of treating egg masses is painting them with creosote, to which a small amount of lamp black has been added, between the first of August and the first of April. The coloring is simply for the purpose of plainly marking the treated egg masses. This preparation is generally available in the gipsy moth infested area, and as the need develops it may be obtained from hardware or seed stores. It is usually inadvisable to remove and burn egg masses on account of the almost inevitable breaking of the mass and the loss of eggs.

Barrier bands. These are frequently applied to the trunks of trees for the purpose of preventing caterpillars from ascending. Within recent years a very satisfactory banding material has been developed cooperatively by the Federal bureaus of entomology and chemistry. It is black, greasy, and is applied to the trees with a special apparatus known as a "gun," which leaves a thick, narrow band over which the caterpillars are unable to crawl. The bands should be kept in a fresh condition during the caterpillar season. No preliminary scraping or treatment is necessary with this banding material. Creosoting egg masses on trees supplemented by banding gives very efficient protection even if there are numerous egg masses on trunks, stones, etc. below the bands, since it is then impossible for the caterpillars to climb the trees. This treatment saves a large amount of expensive ground work, and under certain conditions may result in the wholesale destruction of caterpillars.

Forest areas not too heavily infested with gipsy moth can be saved from defoliation sometimes by applying sticky bands and keeping them in good condition throughout the caterpillar season. In the case of badly infested woodland, it is usually advisable to creosote all egg masses that can be reached above the point where the bands are applied. It is also desirable to band roadside trees or those near stone walls.

Burlap bands. Gipsy moth caterpillars usually seek shelter during hot, sunny days, and under such conditions large numbers will crawl under bands of burlap and can be readily killed. Ordinarily a strip about eight inches wide is placed loosely around the tree trunk and tied with a piece of twine passed around the center, the upper part being turned down to form a double shelter. These bands are especially useful in extermination work in localities where the brown-tail moth is not prevalent. They have not been used during the last few years in eastern New England on account of the expense. In areas infested by the brown-tail moths the bands should not be attached to the trees until after June 15.

Control in orchards. The calyx spray is satisfactory in sparsely infested orchards, provided 10 pounds of paste arsenate of lead are used to 100 gallons of water. In case there is a somewhat serious infestation, a second application should be made early in June—the second codling moth spray comes at about the right time. A bad infestation may necessitate creosoting egg clusters in winter, as well as spraying. Poor or hollow trees should be removed, and if a badly infested woodland is nearby, the orchard trees should be protected with sticky bands. Well-sprayed orchards should not become seriously infested with gipsy moth caterpillars.

Forest practices. It is becoming increasingly evident that control of gipsy moth in ordinary woodland areas may depend in large measure on forestry measures, possibly closely restricted in their application, rather than on costly hand work such as that described above.

Referring to the list of food plants on page 13 it will be noted that a number of valuable trees are practically immune from serious injury, if grown in pure stands or in association with the less favored food plants. The decision in regard to any wooded area should be made only after a careful examination by someone reasonably conversant with the various factors. It is well known, for example, that mixtures of chestnut, pine, red maple, ash and hickory in almost any proportions are seldom injured by gipsy moth. On the other hand, a little birch, oak, or other favored plants intermixed may be productive of serious injury to trees in their near vicinity. The forest problem is a grave phase of the gipsy moth situation.

Allowing the gipsy moth to spread would, in a large measure, nullify our forest policy responsible for extensive forest preserves, the planting of millions of young trees for reforestation of extensive areas, and an elaborate system for fire protection—all designed to offset a shortage in forest products likely to become acute in the near future.

Scouting. This work occupies a very important place in gipsy moth control work. It is necessary not only to know the extent of the infested area but also its general character before deciding on the methods that can be employed to the best advantage. The term scouting is also used at times to designate a certain measure of clean-up work in a sparsely infested area, since the mere finding of an egg mass is not important if the caterpillars are allowed to hatch; whereas treatment of these egg masses would frequently mean an economical and reasonably effective clean up. Incidentally, it should be stated that scouting calls for very careful and thorough work, which is impossible if men have not had a reasonable degree of training and are possessed of certain indispensable qualifications, such as a liking for the work, keen powers of observation, and absolute integrity.

EXTERMINATION AND BARRIERS

The policy in New York State has been to exterminate remote infestations, and this has also obtained in other parts of the country. There has been no serious question as to the advisability of this under such conditions. The practicability and economy of exterminating local infestations has been repeatedly demonstrated within recent years.

The prevention of spread, using the term literally, is a modified form of extermination, and there is abundant ground for believing it to be as effective, and under certain conditions at least as economical, as the extermination of remote infestations.

Briefly, a retreating fight due mostly to insufficient funds and not much less costly than the maintenance of an effective barrier, has been in progress for the last thirty years, the various agencies concerned giving ground before the slow and apparently inevitable advance of the gipsy moth. This has occurred not because it was

impossible to check the advance but on account of the failure of those who decide policies, to grasp the essentials of the problem and to deal with the situation in a constructive manner. An estimate of the cost of actual extermination¹ of the insect in the then known infested area was submitted in 1897 and again in 1899 by the late Professor C. H. Fernald, then Entomologist of the Massachusetts State Board of Agriculture, and dean of those dealing with the gipsy moth problem at that time. It was substantially as follows: \$200,000 annually for a period of five years, \$100,000 annually for a period of five years, and \$15,000 annually for another five years — a total of \$1,575,000. Extermination at that time was in sight and the work was abandoned shortly thereafter because it was so well done that there was little or no local damage, and the popular tendency to underestimate danger in the absence of striking evidence to the contrary obtained the ascendancy.²

The above estimates should be compared with the cost of suppressive work in the infested area of Massachusetts in 1921, which amounted to \$836,108.40, according to figures compiled by the Massachusetts State Forester William A. L. Bazeley. The application of the equivalent of this annual tax for two years would have more than covered the estimated cost of extermination in 1897 and 1899. It may have been that the figures were somewhat below actual requirements. The fact remains that subsequent developments demonstrated the possibility of exterminating this insect over considerable areas and under far from favorable conditions. Those most familiar with the situation consider it simply a question of sufficient funds and proper organization. It appears as though a most gratifying success had been narrowly missed.

New York State is confronted by the option of allowing this pest gradually to extend over its entire area, and if this occurs and the figures and methods obtaining in Massachusetts are a fair criterion of what may be expected in this state, there will be an annual increased cost for all agencies amounting to over five and one-quarter million dollars; or an attempt may be made to prevent further spread.

The Federal Government is now undertaking to delay and hinder spread along the entire border of the infested area, this line measuring more than 450 miles, or fully the distance from some point on Long Island Sound northward through portions of the Harlem, the Hudson River, and the Champlain valleys to the Canadian line and thence westward to Lake Ontario. There is throughout most of this line a strip 20 to 25 miles or even more, in width, with a relatively small proportion of forest areas. In view of this, a serious attempt actually to prevent the gipsy moth

¹ 1897, Rep't State Bd. Agr. (Mass.) on Exterm. of Gipsy Moth, p. 13. Also 1899 Rep't State Bd. Agr. (Mass.) on Exterm. of Gipsy Moth, p. 432.

² 1901, Rep't St. Bd. Agr. (Mass.) on Gipsy Moth, House, No. 204, pp. 9-16.

from spreading westward beyond such a zone — said zone to be determined only after a careful examination of the physical characteristics of these areas — has been suggested.

It is not proposed to abandon the repressive work being conducted at the present time, but simply to ascertain by examination the most favorable location for a barrier zone, the zone to be extended and perfected as the oncoming infestation approaches what might be characterized as a dead line. In other words, the final establishment of this zone would be the work of years.

The reason for suggesting the line indicated is that the physical conditions in this territory are more favorable for successful control than farther eastward in the thickly-wooded, rough Berkshire hills, and areas of similar character north and south. This line as pointed out is no longer than the present border of the infested territory, and practically the only modification suggested is to make this a permanent barrier, and thus profit by the thirty year's experience in fighting the insect in New England, which latter has demonstrated the possibility of local extermination and the prevention of spread. It is to be expected that through wind spread or other means occasional infestations will be found west of the barrier zone. The policy of extermination heretofore applied to isolated infestations would be continued in all such cases and include everything beyond the barrier zone. Some modifications in the barrier zone, eliminating favored hosts, would doubtless be practicable and greatly reduce the difficulties in checking spread. The maintenance of this zone would cost much less than unsatisfactory control measures applied to the entire area of the state, not to mention the protection afforded to other states west and south.

The national phases of the problem abundantly justify substantial cooperation by the Federal Government, and with this practically assured, there is no insuperable difficulty in the execution of such a policy. There is an opportunity in this connection to visualize possibilities, and to take advantage of a situation which can not be remedied if the insect is allowed to spread slowly throughout most of the United States.

Present conditions offer a splendid opportunity for the development of a constructive policy, and if anything of the kind is attempted, we would urge most strongly the avoidance of a parsimonious and short-sighted attitude, which in earlier years resulted in insufficient and delayed appropriations — both well nigh fatal to any such undertaking.

LITERATURE

Literature relating to the gipsy moth is exceedingly voluminous. The most important sources of information in this country are the reports on the gipsy moth work published by the Massachusetts State Board of Agriculture, 1891-1900; by the Superintendent of the gipsy moth work, 1905-1908, and by the Massachusetts State Forester from 1909 to date. The reports of

the Federal Secretary of Agriculture from 1906 to date contain much information regarding this insect, and the same is true of the reports of the State Entomologist of Connecticut for the same period.

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REPORT OF

DISCUSSIONS ON THE GIPSY MOTH

AT THE

INTERSTATE CONFERENCE ON GIPSY MOTH
AND EUROPEAN CORN BORER

HELD AT THE

DEPARTMENT OF FARMS AND MARKETS

Albany, N. Y., November 16, 1922

REPRESENTATIVES AT THE CONFERENCE

(Note: Those indicated with "A" are persons engaged in administrative work in connection with gipsy moth and European corn borer. Those with "B" are especially in charge of gipsy moth, and those with "C" specialize on European corn borer.)

U. S. Department of Agriculture

- (A) Dr. L. O. Howard, Chief, Bureau of Entomology, U. S. Department of Agriculture, Washington, D. C.
- (A) Dr. C. L. Marlatt, Chairman, Federal Horticultural Board Washington, D. C.
- (A) Dr. E. D. Ball, Director of Scientific Work, U. S. Department of Agriculture, Washington, D. C.
- (C) Dr. W. R. Walton, Entomologist in Charge, Cereal and Forage Insect Investigations, U. S. Department of Agriculture, Washington, D. C.
- (B) A. F. Burgess, In Charge Gipsy Moth Work, Melrose Highlands, Mass.
- (B) H. L. McIntyre, In Charge Gypsy Moth Scouting, Melrose Highlands, Mass.
- (C) L. H. Worthley, In Charge Corn Borer Work, 10 Court St., Arlington, Mass.
- (C) D. J. Caffrey, In Charge Corn Borer Laboratory Investigations, 10 Court St., Arlington, Mass.

Dominion of Canada

- (A-C) Leonard S. McLaine, Chief, Division of Foreign Pests Suppression, Department of Agriculture, Ottawa, Canada.
- (B-C) Dr. J. M. Swaine, Forest Entomologist, Department of Agriculture, Ottawa, Canada.

New England States

- (A) Hon. A. W. Gilbert, Commissioner of Agriculture, Boston, Mass.
- (B) George A. Smith, Forester in Charge of Gipsy Field Work, Boston, Mass.
- (B) Charles O. Bailey, Secy. Division Forestry, Boston, Mass.
- (C) R. H. Allen, Director, Division of Plant Pest Control, Department of Agriculture, Boston, Mass.
- (B) W. A. Osgood, Assistant to Deputy Commissioner of Agriculture, Durham, N. H.
- (A) Dr. W. E. Britton, State Entomologist, New Haven, Conn.
- (B-C) Ralph A. Sheals, Assistant State Entomologist, Providence, R. I.
- (B) Harold L. Bailey, Asst. to Commissioner of Agriculture, Bradford, Vermont.

New Jersey

- (A) Dr. T. J. Headlee, State Entomologist, New Brunswick, N. J.

New York State

- (A) Berne A. Pyrke, Commissioner of Farms and Markets, Albany, N. Y.
- (A) George E. Hogue, Asst. Commissioner, Department of Farms and Markets, Albany, N. Y.
- (A) Dr. Geo. G. Atwood, Director, Bureau Plant Industry, Department of Farms and Markets, Albany, N. Y.
- (A) B. D. Van Buren, Asst. Director, Bureau Plant Industry, Department of Farms and Markets, Albany, N. Y.
- (A) F. E. Foster, Secretary, Department of Farms and Markets, Albany, N. Y.
- (B-C) Dr. E. P. Felt, State Entomologist, Albany, N. Y.
- (B-C) D. B. Young, Asst. State Entomologist, Albany, N. Y.
- (B-A) C. R. Pettis, Supt. State Forests, Albany, N. Y.
- (B-A) W. G. Howard, Asst. Supt. State Forests, Albany, N. Y.
- (B) H. H. Teal, District Forest Ranger, Troy, N. Y.
- (B-C) Dr. P. J. Parrott, Entomologist, State Experiment Station, Geneva, N. Y.
- (B-C) Dr. Glenn W. Herrick, Entomologist, State College of Agriculture, Ithaca, N. Y.
- (B) J. R. Simmons, Sec., N. Y. State Forestry Assn., Albany, N. Y.

REPORT OF CONFERENCE

The conference was devoted in the forenoon to discussions on the gipsy moth, the report of which is given in the following pages.

The afternoon session was consumed in considering the problem connected with the European Corn Borer, a report of which may appear later in circular form.

Discussions on corn borer were led by Messrs. Ball, Howard, Walton, Caffrey, McLaine, Gilbert, Britton, Felt and others. The resolutions on page 58 were unanimously adopted, and with the resolutions on the gipsy moth were given preliminary distribution.

The purpose of the conference was stated in the call of November 8, 1922, as follows:

Commissioner Pyrke invites you to a conference at this office Thursday, November 16, 1922, at 9:30 A. M.

The purpose of this gathering is to discuss the *Gipsy Moth* which has spread to the eastern border of New York and is also found in localities outside of the Federal quarantined areas, thus constituting a menace to gipsy-free territory.

A second subject of discussion is the *European Corn Borer*. The extensive spread of this insect is important to many interests.

The life history of these pests is well known to those to whom this call is addressed. It is therefore proposed, if the conferees agree, to devote the short time at our disposal to a discussion of a general policy and of ways and means.

The conference was called to order at 10 a. m. by Commissioner Pyrke, who extended a cordial welcome to those present, and called on Dr. Atwood to outline the purpose of the conference.

DR. ATWOOD: I think, Commissioner Pyrke, that you have before you the representative men in handling the problems connected with these two insects. The problem before us today is one that has been forced upon us by national conditions, as indicated by the natural spread of the gipsy moth. Starting in Boston, it has now extended in all directions at least 150 miles. According to the latest information, it extends along the New York border a distance of about 75 miles.

The possibility of exterminating the gipsy moth is one that has been the subject of discussion for many years. In the effort of control large sums of money have been expended. In New York State we have before us a question which will ultimately have to be considered by the states farther west. This seems to be the time when a policy should be mapped out, drawing lessons from the last thirty years' experience of fighting the pest in New England. We want to see what should be done, and then the problem will be, what can be done.

We have experts in all these problems present, and I think they are willing to give their experience and advice.

COMMISSIONER PYRKE: Doctor, will you suggest some gentleman who will be able to discuss and outline this matter to us on a national scope.

DR. ATWOOD: I think we can well begin with what Dr. Felt has to say.

ADDRESS

DR. E. P. FELT

New York State Entomologist, Albany, New York

A map recently issued by the Federal Government shows that the territory sparsely infested by the gipsy moth abuts on our eastern boundary from a part of southwestern Vermont to a portion of northwestern Connecticut, including therein the entire Massachusetts boundary, a total of possibly seventy-five miles. A map published by the Federal Government in 1921 showed little infestation in Massachusetts west of the Connecticut River and one issued in 1920 indicates in the southern two-thirds of Massachusetts a considerable area east of the Connecticut River free from infestation. In other words, this westward spread of fifty miles or more has presumably occurred in two seasons.

Anyone at all familiar with the gipsy moth knows that these conditions mean presumably some infestation along our eastern border and within New York territory, and even if such does not exist at the present time, the probabilities favor such an infestation within a season or two. There is no escaping the conclusion that New York State has an extensive gipsy moth problem imminent, and in view of the fact that this infestation is now an extension of the main infested area, it is considered advisable to canvass the situation rather closely. Experience with this insect has taught us that if we are going to handle a problem of this nature it must be taken in time.

We have had the gipsy moth in New York State in the form of a few scattered infestations for a number of years. We have cleaned these up very successfully and probably have actually exterminated the insects in several localities; and, unless I misjudge the situation, Mr. Burgess of the Federal Bureau of Entomology is willing to state that extermination is simply a question of organization and means.

A new insect problem is facing New York State. We are on the edge of an advancing invasion which is bound to cross the boundary, and the important question is, What should the state of New York attempt to do, and if it attempts to do anything, what can it expect in the way of cooperation from any other agencies, especially the Federal Government?

Most of us know something of the fight against this pest in Massachusetts. The infestation started at Medford, Massachusetts, in 1868. A program of extermination was begun in 1891 and abandoned in 1900. Work against this insect was resumed on a repressive basis in 1905 for the simple reason that the widespread destruction caused by this pest was so severe that it forced resumption of activities.

The status of the gipsy moth as a pest is indicated somewhat by the fact that nearly twenty million dollars have been spent in New England and adjacent areas in efforts to exterminate and control the insect, mostly the latter. The total expenditure in

Massachusetts in 1921 for control of the gipsy moth in the then infested area — probably less than three-fourths of the total area of the state — amounted to the tremendous sum of \$836,108.40, according to figures compiled under the direction of the Massachusetts State Forester William A. L. Bazeley and placed at our disposal. The state of Connecticut has had a gipsy moth problem since 1906, and at the present time considers the gipsy moth such a serious pest that it has expended approximately \$1,000 per infested town annually in control work.

If we take the later experience of Massachusetts as some criterion of what the expense might be in New York State if the insect became established over our entire area, the total for control work that would be expended by all agencies would amount to some five and one-quarter million dollars. If we take the Connecticut standard of \$1,000 per infested town as a basis, our annual costs just for control work would run up to about one million dollars. The Connecticut infestation differs markedly from parts of the infested area in eastern Massachusetts in that it is sparse, and consequently the figures would not adequately represent the cost of controlling a general infestation in this state.

The one important problem is to work out a program that will be practicable and one that can be followed for a number of years. The state of New York has expended considerable sums in the purchase of lands for forest preserves in the Catskills and Adirondacks, for the installation of fire towers and for the development of adequate fire protection, and in raising and planting young trees for the purpose of encouraging the development of forestry throughout the state.

It can not be that these large forest preserves, this protection from fires, and the extensive planting of young trees has been for the purpose of providing the gipsy moth with abundant and varied provender? This incoming invasion of what we must all admit to be a serious forest pest, is a direct challenge to the present forestry policy of this state and actually compels the adoption of a progressive attitude toward the control of the gipsy moth, unless we are willing to repudiate our forestry program — something almost unthinkable under present conditions.

Referring once more to the maps showing the spread of the gipsy moth, we find that in the Massachusetts area at least there has been a westward extension of approximately twenty-five miles during the last two or three seasons. If the same rate prevails, the pest will be in the Hudson Valley within a season or two, and is possibly established on its eastward margin at the present time. In other words, the danger is imminent and there should be no delay in working out a policy that can be followed advantageously.

It has been repeatedly demonstrated that isolated infestations of the gipsy moth can be exterminated; and, judging from present indications, we may anticipate such an outcome in the near future in the case of the extensive infestation which was discovered a

few years ago in New Jersey. This is the only infestation of any size west of the Hudson Valley.

Mr. Burgess, an authority on the gipsy moth, has repeatedly stated that the extermination or prevention of the spread of this insect is simply a question of organization and means, an undertaking greatly favored by the fact that there is no spread by the flight of moths. It appears entirely reasonable to assume that the spread in the last few years has resulted in part at least from insufficient funds, and the effectiveness of those available has been materially decreased by the abnormally high prices prevailing.

A study of the present border line of the infestation, particularly that directly to the east of New York State, shows that the gipsy moth is gradually extending over a rough, rather generally wooded country offering the maximum obstacles to the successful prevention of spread. We have in the Hudson, Champlain, and St. Lawrence valleys a great natural and practically continuous area offering as good opportunities for actually holding the gipsy moth as can be found in any of the infested territory in which the pest has already established itself. I wish in this connection to suggest the possibility and the practicability of attempting actually to hold the gipsy moth infestation along some such line. It is not proposed to abandon repressive work along the present boundaries of the infestation, but simply to recognize the fact that the insect will soon enter the more open country, and that in this latter, namely the more open sections of the Hudson Valley, it may be entirely possible to establish a barrier zone beyond which the insect shall not be allowed to maintain itself. The precise location of this area would be determined by a careful examination of the wooded and cultivated sections of the Hudson and Champlain valleys and the northern boundary of New York State westward to Lake Ontario. The establishment of such a barrier zone would be a gradual process extending through a series of years and determined in large measure by the westward spread of the moth. The entire line extending from some point on Long Island Sound northward and westward to Lake Ontario would be shorter than the present boundary of the infested area along all of which repressive work is being conducted. The maintenance of a successful barrier zone would mean immunity from gipsy moth ravages for all New York territory to the west of that area, not to mention the protection given to other states, provided isolated infestations which presumably will be found from time to time beyond this line are exterminated. In view of the great and constant annual expense falling on infested areas in New England, it is easy to see that the cost of maintaining such a zone would be much less than attempts to control the gipsy moth over a considerable proportion of New York State, if it became infested; and this latter is to be expected, unless some such plan is put into practice. In the latter event, there would also be in addition to the cost of controlling the infestation, the enormous and widespread losses resulting from

severe injuries to forest and shade trees throughout the infested area.

It would seem in view of the national aspects of the problem, that the Federal Government might well be expected to cooperate in a very substantial way in maintaining this barrier zone, provided infestations to the south and west, present or future, are exterminated, and there is a reasonable assurance of satisfactory cooperation from the state or states most vitally interested.

The plan as outlined does not contemplate the immediate establishment of such a zone. The actual determination of any such area would require the careful examination of the Hudson Valley and other sections for the purpose of ascertaining where the most favorable conditions exist for holding the insect. A line, which probably offers the maximum possibilities, has been indicated by Mr. W. G. Howard, Assistant State Forester, substantially as follows: It should extend from some point on Long Island Sound up the Harlem Valley, the center line passing through approximately the following points — Bedford, Golden Bridge, Brewster, Patterson, Poughquag, Millbrook, Clinton Corners, Rhinebeck, Red Hook, Tivoli, thence following the Hudson River northerly to Fort Edward and thence the Champlain Canal to Lake Champlain. A forest map shows that such a line would include considerable forest lines in some sections, notably in Putnam and southern Dutchess counties and at the extreme northerly end of the line in Canada. It is believed that such a location offers the most feasible route that can be found and it is certainly worthy of detailed examination.

COMMISSIONER PYRKE: My interpretation is, that with the enemy attacking in force we should set up a combating force comparable to the Hindenburg line. I wonder if we could next hear a word from Mr. Bailey, of Massachusetts.

DISCUSSION

CHARLES O. BAILEY

Secretary, Massachusetts Division of Forestry, Boston, Mass.

Speaking as a representative of the Massachusetts Conservation Department, I first desire to convey to you the greetings of Commissioner Bazeley who has authorized me to state that Massachusetts will cooperate in carrying out any reasonable program which may be determined on by this meeting with respect to the control of the gipsy moth. Because of the limited time allowed, it will be difficult for me to review in the fullness of detail the history of Massachusetts' fight against the gipsy moth. Most of you gentlemen are aware of the fact that I am not an entomologist. Such knowledge as I possess concerning the gipsy moth has been acquired through twenty-five years' service in the control work carried on by my state.

Slow but sure has been the spread of this insect, so that today it is found in nearly every city and town in Massachusetts. Indif-

ference and skepticism may be given as potent factors in bringing about this condition. From the time that the first appropriation was asked for down through all the years to the present time, it has always been difficult to impress upon the minds of many of our legislators the fact that the gipsy moth constituted a very serious menace. As Dr. Felt has already pointed out, Massachusetts, after carrying on a campaign of extermination for a period of ten years, in the year 1900 ceased its efforts altogether, and for a period of five years no effort was made to check or control the insect. As a result of this very serious mistake, it spread rapidly, so that when operations were resumed in 1905 its presence was found in nearly ten times as much territory as was infested when operations ceased. I refer to this unfortunate action of the General Court and the serious consequences which followed for the reason that strange as it may appear, notwithstanding that Massachusetts has expended approximately \$15,000,000 in its efforts to control the pest, we find a certain number of legislators each year who still regard gipsy moth suppression work as an unnecessary expenditure. I have even heard men go so far as to express the belief that no serious damage would have resulted to the tree life of our Commonwealth if this expenditure had not been made. As a matter of fact, investigation will show that a vast amount of damage has been done in spite of the unparalleled fight which has been waged to prevent it. I reside thirty-five miles north of Boston in a section where there is a great deal of woodland, and I venture the statement that it would be next to impossible for one to go there today and buy cordwood without finding that one-third of it had been killed by the gipsy moth before being cut, and were it not for the extensive spraying operations which have been carried on there for years, the percentage of dead trees would be far greater.

Our object in Massachusetts is to control the insect, as we long ago abandoned hope of exterminating it. The first law enacted by our Legislature in 1889 by its provisions contemplated the extermination of the insect. This law was administered by the Department of Agriculture and the state bore the entire expense of the work. The law enacted in 1905 provided for a more equitable distribution of the cost of suppression divided up among the private property owner, the municipality, and the Commonwealth. Its policy of dividing the cost has been adhered to up to the present time. Conditions in Massachusetts are somewhat better than they were a few years ago, notwithstanding the increased area of infestation. To be more explicit, I would say that we have by our methods of treatment succeeded in preserving our shade trees, have protected our orchards, and have prevented serious defoliation in many woodland areas. There was a time in the heavily infested areas of the state when many farmers found it difficult to finance the work necessary to give their property adequate protection. Conditions are so improved, however, that in most of our farming communities the cost of necessary moth work has been reduced to a minimum.

In my opinion, it is absolutely imperative that this meeting devise means of enlightening the people of the state of New York and other sections of the country threatened with invasion by the gipsy moth of the gravity of the situation. Also this meeting should outline a definite plan of action to prevent, so far as possible, the further spread of the pest. We realize that the suppression of this dangerous pest is an expensive work, but the protection of forest, shade, and fruit trees certainly justifies the cost.

I will take no more time of the meeting as Mr. George A. Smith, Superintendent of Moth Work in Massachusetts, is present, and will tell you how control work is conducted in our state and general conditions there.

GEORGE A. SMITH: Gentlemen: I want to say that conditions in Massachusetts at the present time are much better than they have been for several years. This applies both to the gipsy and to brown-tail moths. In going over the work this fall we have not found one nest of the gipsy moth, where several were found other years.

It is spreading in the western part of the state, but in the territory where the infestation has been heavy we are getting it under control. We have had much less stripping this year than in a number of years past.

COMMISSIONER PYRKE: If you had sufficient resources, could you down this enemy?

MR. SMITH: There is no question, whatever, as to that. In the heavily infested territory it is decreasing, although a number of new towns have been found infested toward the New York line.

COMMISSIONER PYRKE: On the whole, is the area increasing or decreasing?

MR. SMITH: Increasing.

COMMISSIONER PYRKE: Is it widening in all directions?

MR. SMITH: Throughout Massachusetts, yes. Mr. Burgess, who has charge of the moth work for the United States Department in 35 towns in the western part of the state toward the New York line, could answer that better.

DR. C. L. MARLATT: Your point of view is that it has become an insect that is controllable and can be controlled. You are controlling it in the old districts, so that the damage is reduced to the minimum and is a negligible one?

MR. SMITH: That is right.

PROF. P. J. PARROTT, GENEVA: May I ask how you are handling your state forest plantings in Massachusetts?

MR. SMITH: I do not know of any infestations existing where our forest plantings are. We have not had to do any work in any forest plantings as yet.

DR. HOWARD: How is the situation on Cape Cod?

MR. SMITH: It is much improved there.

DR. HOWARD: The scheme of operation between the Federal Government and the state is that the state takes care of the interior operations and the Federal Government is trying to prevent the spread along the borders.

COMMISSIONER PYRKE: I think you have answered our questions pretty well. We are indebted to you.

As this question is national in its scope and sweep, it is very fortunate to have here representatives, both of the states affected and a representative of the Federal Government, and it is with very great pleasure at this time that I will present to you the representative of the United States Department of Agriculture in the person of Dr. L. O. Howard, Chief of the Bureau of Entomology.

DR. HOWARD: I would rather have Mr. Burgess talk on this problem, because he has lived there on the ground.

DISCUSSION

A. F. BURGESS

In Charge of Gipsy Moth Work, Melrose Highlands, Mass.

Mr. Chairman and gentlemen: As has been stated very clearly by Mr. Bailey and as I think is well understood by all of you, the gipsy moth is a very serious and destructive insect. I do not think there is need of any special evidence on that point, but in going through some of the records that we have secured during the last ten years from selected areas throughout the infested territory, I find that 26 per cent of the red oak trees are dead as a result of gipsy moth defoliation. I have further information as to the effect on the rate of growth of trees that have been stripped, because the killing of a tree by defoliation, or the killing of some trees in an area by defoliation, is not the whole story of the damage done. The damage to the particularly vigorous trees may not result in death in a short series of years, but it does result in retardation of growth; and, taken on the basis of a forest, it means retardation of board feet, which means loss in money, although the average owner may not see it, or may not appreciate it. This is an important factor in connection with trees which are defoliated but which do recover.

The Federal work has been carried on with the purpose of preventing the spread of the gipsy moth, so far as was possible, regardless of state lines and regardless of expenditure in any particular locality. The problem has been handled from our point of view as a unit, and ordinarily in this work arrangements are made whereby the states take care, to the best of their ability and the best of their resources, of the territory inside the border, and the Federal Government handles a strip along the outside area.

That brings up the point which Dr. Howard raised, that the states had been successful along their line, but the Federal Govern-

ment had not succeeded in preventing spread further along the border. As a matter of fact, for about four years following 1913 there was very little spread, and 1913 indicates about the beginning of our appreciation of the value, or the importance rather, of wind spread as the principal means of distributing the gipsy moth. The gipsy moth was then confined largely to the Connecticut River valley on the west. Since that time there has been more spread and I think perhaps in order to show some of the reasons for that I should give you a few details.

I know it is customary to lay all our troubles to the war. We won't lay all our gipsy moth troubles to the war, but war conditions made it impossible at certain times to do all the work that should be done. The appropriations for the work on the border remained stationary throughout the war period. The costs of everything increased. There was a scarcity of labor, everyone knows, and at times it was extremely difficult to maintain an adequate force to do the border work that we desired to do. In 1920 the prices of everything were extremely high, but the appropriation was stationary. We asked in 1919 — and requests for Federal appropriations are made practically two years in advance — for an increase in the appropriation of \$100,000. Congress responded with a cut of \$75,000; so that for the fiscal year 1921, that is, from July 1, 1921, we began with a cut of \$75,000, from the amount we had previously had. Our plans were made accordingly, and almost immediately an infestation of the gipsy moth was found in New Jersey. Now, since that time we have been struggling to get along financially. It is true that we received a deficiency appropriation of \$225,000 to use in the New Jersey work, and to supplement some of the New England work that could not be done on account of the decreased appropriation, but that money was not available until March and you can't keep men working when there is no money available.

We have experienced practically the same situation this year, as a result of not having the funds at the time when most needed to do the work.

In handling the work along the border in New England, it is necessary to do the work in the northern part of the territory first, because if that work is not done before deep snow comes, there is very little chance that it can be done early in the spring, because conditions are very difficult in spring in that northern territory. For two years, and part of three years, it was impossible on account of lack of funds to complete the work that should have been done in southern Vermont, and in Massachusetts and Connecticut.

There is another factor that enters into the problem and that is the wind spread situation in the Connecticut Valley territory. A number of years ago it was determined by experimental work that the bulk of the spread, based on records secured in eastern Massachusetts and southern New Hampshire, was toward the north and northeast, because the prevailing winds at the time of hatching

and when the temperature was high enough so the caterpillars would be active, were generally toward the north and northeast. The records that we have been able to secure from some of this area in the Connecticut Valley indicate that this rule does not hold as accurately in the Connecticut Valley as it does along the seaboard. There are more southeastern and easterly winds with a relatively high temperature during the crawling season of the small caterpillars, which results in a greater possibility of caterpillars spreading toward the west, if hatched in the Connecticut Valley, than would be the case if hatched along the seaboard.

These two factors, I believe, account largely for the unusual extension of the infested areas in western Massachusetts and in Connecticut during this year. There has been found this fall one town adjoining the Massachusetts border in New York State, with two infestations, one of one egg cluster and another of 28 egg clusters.

The plan of work we are attempting to carry on along that border is to scout and clean a twenty-five mile strip, the idea being that what wind spread over more than twenty-five miles is negligible and that by cleaning a twenty-five mile strip along the border, we will put ourselves in a position to hold the insect within reasonable limits. That plan was adopted last year, but we were short of funds in the winter, when a great bulk of work should be done, and it could not be completed; but the plan is in operation.

I want to say one other thing in regard to the conduct of this field work, which perhaps some of you who have not come in close contact with it do not realize. The question of securing, training and holding competent men is no small one during such periods as we have had for the past five years. During the war period, many men left for the war, and many went into industries of one kind and another. It was necessary continually to recruit and train men in order to keep a force intact. Last year we planned at the beginning of the fiscal year we could carry our labor on a 15 per cent decrease. The price of labor was falling, and that was put into effect. We cannot do it to-day. If we are to believe what we see in the press reports in regard to labor conditions, by another 8 or 10 months there will be a serious shortage of labor. Those things affect this work and must be taken into consideration; they constitute some of the difficulties of the problem. The labor proposition is difficult to handle and it means a great deal toward the success or failure of the work. If the price of labor you hire is increased 10, 15 or 20 per cent during the year, that means the work you can have done is decreased 10, 15 or 20 per cent. Estimates on this kind of work are difficult, especially so when they have to be made approximately two years ahead of the time when the money is used.

The problem as I have thought it out, so far as New York State is concerned, follows along about this line: The infestation has spread practically to the New York border, in several places. There is a possibility that by intensive scouting there may be

found infestations in the Hudson Valley. With the funds at our disposal and with the attempt that we are trying to make to carry through the New Jersey and other lines of work we are not in a position to take care of more than the twenty-five mile strip along the border. We must provide for the quarantine and inspection work for all products going out of the territory, and carry on the necessary experimental work.

I believe the first thing that should be done is to determine whether there are scattered infestations in the Hudson Valley, and upon the determination of that would depend, in a considerable measure, what kind of a program should be followed. I believe it is only fair that the state of New York should finance that scouting. For years this state has been protected from gipsy moth infestation by the border work in the New England states, and it seems to me that this is the pressing problem at the present time.

Dr. Felt has spoken in regard to a policy of work, outlining the idea of a line in the Hudson Valley. I must confess that I am not very familiar with the Hudson Valley territory and of course Dr. Felt and you men in New York know better than I do as to the lay of the land and the tree growth throughout that valley. From what little I know, I would believe that the chances for holding the moth are better in the Hudson Valley territory than in the territory further east, which is much more heavily wooded and is of a more rugged character.

DR. HOWARD: What are the chances for wind spread from the hills back of Garrison?

MR. BURGESS: You probably are more familiar with that territory than I am, Dr. Howard. The hill regions, of course, would have to be given attention, and there is no question but that an infestation in the hills will give rise to a great deal of spread, if it is not taken care of. There is probably some rugged territory in the Hudson Valley region that would have to be attended to, but, as a general proposition, taking the valley as a whole, I should suppose it would be more favorable territory to work in from a scouting and clean-up point of view than the territory further east. Mr. McIntyre is here and I think he has travelled over some of that territory and has gone through some of the towns in the eastern part of New York State, along the Massachusetts line, and before the meeting closes I would like to have his views on that particular point.

COMMISSIONER PYRKE: Mr. Burgess, have you had any opportunities to observe what the effect of low temperatures has been on this insect?

MR. BURGESS: Yes. You asked that question earlier in the meeting and it was not answered. We have done a great deal of work to determine the effect of low temperatures on gipsy moth eggs, and we have determined that a temperature of 20° below

zero is fatal to the eggs. Most people would naturally say, all that is necessary is to take the map and get the temperature records, and then draw on that map a line where the temperature records run below 20°, and all outside of that line are dead. But there is one hole in this problem that is a very bad one. To be killed the eggs must be unprotected. Any artificial protection, such as snow, or if the eggs are laid in cavities of hollow trees, or on stones on the ground, or are protected in other ways, renders that temperature ineffective. I had great hopes in carrying on these experiments, because I thought that particularly in Maine, where the temperature runs very low, and in some other areas in New England, we might eliminate a large amount of field work by simply using temperature records. It developed, however, that if eggs had been laid near the ground, below the snow line they would hatch, and in a great deal of this area, many of the eggs are so laid.

COMMISSIONER PYRKE: I am asking that question because we have representatives of the Conservation Commission here who are naturally concerned about our Adirondack territory where we have some very low temperatures. Suppose the temperature dropped to 30 degrees below zero, would the element of protection still appear?

MR. BURGESS: If you had three feet of snow and you had 30 degrees below zero, the eggs below the snow line would survive.

PROF. PARROTT: I am trying to picture what will happen to New York when the gipsy moth gets into the Adirondack and Catskills. I presume in Massachusetts there is considerable lumbering going on. To what extent do the owners of these properties undertake to control the gipsy moth in their respective holdings?

MR. BURGESS: The general policy in Massachusetts, and I think in all New England States, has been that as soon as the gipsy moth infestation becomes bad enough to threaten, they cut the wood and get what they can out of it. In many cases the wood has been cut off before it is matured. You will find in many cases that they are cutting small pine where threatened, and using it for box logs. That is what has happened all over the worst part of the infested territory and that is one reason why it is so difficult to get data on what the gipsy moth actually does to trees over a period of years. Ten years ago we selected 250 areas to make observations on, and they were selected in all kinds of growth and scattered over the entire territory, and we had a great deal of trouble in those areas, because just as soon as the infestation was sufficient to defoliate, the owners wanted to cut.

PROF. PARROTT: You have been studying the resistance of different varieties of trees to attack. What varieties are practically resistant, and what work has been done in Massachusetts in this way?

MR. BURGESS: There has been some work done along this line, but the greater part of the work has been experimental work in the laboratory, backed up by observations over a period of years in selected areas in the field.

PROF. PARROTT: You see we have this vast region, a part of which belongs to New York State and part to individual owners, and I am wondering just what will be the measures adopted by the different owners in protecting their property.

MR. BURGESS: Speaking of susceptibility of trees, the ash, hickory, and some of the trees of these classes are practically immune from attack. The pines are immune from attack by the caterpillars of the first stage, and that applies to a certain extent to the spruces. The poplars and birches are very subject to attack, the beech is a little less so. Some work has been done on the food plants, and there has been a bulletin published that gives a classification. These facts have been used a great deal. If you have an area that is solid white pine, you are safe in so far as the gipsy moth is concerned, but you must keep favored trees out of that area. The same is true with red pine.

DR. FELT: A letter from the Conservation Commissioner of Massachusetts in reply to one from me, asking in regard to the damage in forests, says:

“The oak forests on Cape Cod have been the hardest hit by gipsy moth, and in this section 90 per cent of the trees are dead, and the oak type represents 75 per cent of the forest land.”

PROF. G. W. HERRICK, ITHACA: May I ask two questions: Is that a reasonably feasible proposition, Mr. Burgess. If we maintain that line to Lake Ontario and up the Hudson River Valley—supposing that were possible—what would happen in Canada if nothing were done, and what would be the final effect?

MR. BURGESS: I don't believe I can reply to that.

PROF. HERRICK: Would it be reasonably feasible to hold the territory on any line?

MR. BURGESS: I should say so.

DR. FELT: Would it be reasonably feasible, if you had money, to hold the insect along practically your present border lines?

MR. BURGESS: We have always thought so. We have not had the money.

PROF. HERRICK: What are the natural means of control to date? What are they doing for the gipsy moth in the introduction of parasites?

MR. BURGESS: I think that parasites are modifying the situation to a considerable extent over what it was years ago. It is impossible to select any one town or any small group of towns and secure data from these and apply that data to the whole region. There are too many variations in conditions in the region. But

in the territory near Boston we have been following the conditions very carefully in several towns during the last three years, and this year we found an average of about 35 per cent of egg parasitism in these towns. That means that 35 per cent of the caterpillars that would normally hatch from these eggs, did not hatch at all. We found something like 40 per cent of non-hatch, which would bring the destruction of eggs up around 75 per cent or more. In some localities in these towns there was heavy parasitism of the caterpillars, so that at the time of pupation the caterpillars were reduced very materially. In addition, we had the wilt disease just at the time of pupation, so that at the present time the infestation is no greater than it was a year ago.

There is one other element to be considered. Very unfavorable conditions prevailed at the time of hatching. Any of you who have experimented on a large scale know that there is an enormous mortality of the caterpillars in the first stage. That was higher than normal this year. That partially accounts for a good deal of the favorable conditions that occur in some of the woodlands at the present time.

The handwork that is done — that is, the spraying and treating work — is effective and is good work, but in the wild areas where nothing is done, if you have a combination of maximum parasitism, maximum non-hatch, and wilt disease, in one season, you get very little increase of caterpillar or gipsy moth.

PROF. HERRICK: Do you feel there is a general tendency over the whole infested territory to grow more virulent or less virulent? Is there a tendency for a balance to be struck?

MR. BURGESS: That is a very difficult question to answer, because a great deal depends on climatic conditions. You can't compare one season with another. If you have a very heavy infestation of egg clusters in a locality and you have very cold weather, you will have a very heavy non-hatch, which reduces the infestation. You may not get the same thing in another locality, or may not get it another year, or two or three years from now. There are so many conditions to be considered that it is difficult to answer that question.

DR. MARLATT: In driving through New England, I have gained the impression that either they are controlling the insect or the natural control has stopped it, because I do not see the same areas of absolute bare woodland that were characteristic of the insect in the district about Boston in the early years of its appearance. You have not gone through all of this vast woodland and sprayed and cleaned up. Does that mean a natural balance? Of course, we realize that this natural balance is spotted, but isn't there over the whole district a natural balance coming in? In other words, I get the impression that the gipsy moth is not doing what it has done before. A broad view of the thing is what we want to get at.

MR. BURGESS: Have you taken into consideration the amount of woodland that has been cut off in that territory?

DR. MARLATT: There is a good deal left.

MR. BURGESS: A sprout growth is coming up and it looks like a forest area. Of course, there are plenty of areas on the outside of the section where there has been no damage. We have never had any stripping to amount to anything west of Worcester.

DR. FELT: I have seen personally in the last eight or ten years considerable areas in that territory, which is east of Worcester, stripped of foliage, but I have noticed you have to go through there at the right season. I would not say there had been such a material let-up; there may have been some.

MR. MCINTYRE: Up to the last two years all the woodland colonies that could be found in the territory west of Worcester were taken care of by spraying.

SUPT. C. R. PETTIS: Mr. Burgess referred to the twenty-five-mile strip in Vermont and Massachusetts. I would like to have him tell what he is doing and what should be done on a strip such as Dr. Felt proposes.

MR. BURGESS: The plan is to scout the territory, find the infestations, and treat them. The plan in the area that Dr. Felt proposes would be similar. I do not think there is any point in scouting this area and not treating the infestations, and you do not know where the infestations are until you scout the territory.

SUPT. PETTIS: You do not remove the oaks, birches, or any desirable tree food? .

MR. BURGESS: That depends on conditions. If we found a small colony in an oak and pine stand, and it would appear cheaper and more economical to cut out those oaks, that would be done. On the other hand, if you found a single tree infested, it might be cheaper to do a thorough job of creosoting.

SUPT. PETTIS: What would you say about trying to locate a strip where perhaps 80 per cent of the area is cleared farm land, and there is a very small amount of forest of oak and birch. Would it be desirable to try to eliminate the oak and birch?

MR. BURGESS: I should think if such an area as that exists in the belt, it ought to be investigated with a view of handling it that way. I do not believe it is a good idea to commit yourself to a policy on these things until you find out what the conditions are in the field. You are probably familiar with these; I am not.

DR. HOWARD: Referring to the Adirondack question. There is no doubt but that eventually that region will be reached. I have always thought we could get a point, north of which it would not go. It has its northern point in Europe. I would like to have you make a sort of guess as to the possible further spread in Maine, and the possible further spread in the Adirondacks.

MR. BURGESS: I suppose I shall be accountable later on for any guess I make. So far as Maine is concerned, I do not look for a further serious spread after you get out of the apple region. We

thought several years ago we were practically out of the apple region, but we are still finding quite a lot of apple orchards within this territory in Maine.

So far as the Adirondacks are concerned, I would rather not express an opinion. I would look for the most dangerous section in Canada, in Quebec. A number of years ago I went to Montreal in the daytime, and my impression of that territory along the railroad is that it is flat and not heavily wooded. I would say off-hand that the section through which I went would be a fairly easy section in which to fight the gipsy moth, from the lay of the land and the absence of large forest areas; but that it would be a section where the gipsy moth would survive.

COMMISSIONER PYRKE: Probably the most important thing we have to consider is that of questions of policy. Before we deal with such questions, however, it seems to me we should probe the proportions of this problem a little further in a territorial sense, in order to determine the gravity of the menace, as the gravity of the menace will determine, to some extent, the policy to be followed.

We have here representatives of some of the New England States, and we should have reports from these men. We will next hear from Mr. Osgood of New Hampshire.

DISCUSSION

W. A. OSGOOD

Assistant to Deputy Commissioner of Agriculture, Durham, N. H.

Mr. Chairman, Gentlemen: In New Hampshire conditions relating to the control of the gipsy moth are somewhat different from her sister states in the east. On the eastern side of New Hampshire, from the coast line at Portsmouth to the White Mountains, we have practically solid woodlands, with the exception of a few cities, towns, and farm lands. The tree growth is mostly white pine, hemlock, and hardwood — gray birch predominating among the hardwoods.

In the central part of the state is the Merrimac River valley, which contains some of the best farming country in the state. This country, in general, is much more open and has less forest lands.

The Connecticut River valley on the west is similar to the Merrimac, but is more open and probably has more hardwood growth. Mr. McIntyre can tell you more about this section.

In the southern and eastern sections of the state of New Hampshire, where the gipsy moth infestation is oldest, there has been very little spraying or creosoting since 1912, except in the cities. In this section the State Department, in cooperation with the U. S. Bureau of Entomology, has colonized the different parasites of the gipsy and brown-tail moth. In this area some natural control is keeping this insect within bounds. We have watched the wood-

lands in this section for a number of years, and there are no solid areas where there is continual stripping year after year. You will see areas stripped one year and the next year very little defoliation.

I believe that there are two factors controlling this insect in these woodlands — parasites and cold weather. In this area cold weather helps to control by killing exposed eggs, above snow line, when the temperature falls to 20° F. below zero. Some of the parasites have been colonized as far north as the White Mountains.

Another line of work carried on by the department is to send a representative out when complaints come into the office, who will go over the existing conditions and explain to the property owners what may be done to help the situation. Of course, the thing we advise them to do, where the woodlands are mostly pine mixed with hardwoods, is to remove the hardwood, especially the gray birch. Many will do this. It is not necessary to do all this cutting in a single year. In many cases we have outlined a program for them to follow, over a number of years, removing certain sections of hardwood each year. Where this work has been carried out they have had very little difficulty in controlling the gipsy moth in their pine woodlots. Of course, in a hardwood lot, you have a different problem. In these lots, maple and ash are the two types of trees best to leave.

In the southern part of New Hampshire the parasites and non-hatch are helping to control the gipsy moth.

COMMISSIONER PYRKE: On the whole, are you gaining or losing ground?

MR. OSGOOD: In the southeastern section of our state we are gaining. On the Connecticut River, Mr. McIntyre will have to answer any questions.

DISCUSSION

HAROLD L. BAILEY

Assistant to Commissioner of Agriculture, Bradford, Vermont.

Mr. Chairman: What I have to say will be very brief, because up to this year practically all the work in Vermont has been within the scope of federal operation. It has been all "outside" work. We have had no serious establishment of the gipsy moth, no place where stripping has existed. The federal crews have done very thorough work for several years. Most of the work which has been done by the state has been in assisting them in establishing quarantine lines. This year there has been quite a spread west and that means, I think, that the line intended as our inside limit leaves a row of towns on the Connecticut River east of the federal zone of action, and more than one tier of towns in the southern part of the state. Of course, Vermont is naturally limited in financial resources as compared with the amount of work to be done. Our tentative plan this year with state money is to cover several towns along the Connecticut River which have not been covered for the past two years. However, conditions in Vermont are prob-

ably different from those in other states, because the woodlands of the state are practically all made up of hard wood — birch, maple and beech; oak is comparatively scarce. There are exceptions to that in the extreme southeastern part.

One or two points which have been raised interested me particularly. One was Dr. Howard's suggestion as to a northern limit. I am convinced from what has taken place in Vermont that the gipsy moth will not reach a northern limit, so far as existence goes and so far as spread goes, but whether or not it will reach its northern limit in so far as being a severe pest, I am in doubt. That it will exist there I think is borne out by our experience this year and last year. To make a concrete example of what Mr. Burgess said: We had a small colony about halfway up our state. The previous year one or two egg masses had been found, but two or three egg masses were left, one in an old tin can and one under a stone. That was the year before last. These hatched, and this last year we found quite a number of egg masses, some on trunks of trees, some on sticks and stones on the ground. I took those egg masses and kept them in a warm place. From those found on tree trunks, there was no hatch; the egg masses found on the ground showed practically a full hatch. We had a week in that vicinity last winter when the thermometer, if I recall rightly, ran to 38° below zero and followed at about 30° for three or four days longer. It continued cold, but there was snow on the ground. That would demonstrate to my mind that the insect can survive any winter we have. I think we have about as cold weather as you probably do in the Adirondacks. There were other cases along the line where we know that there was hatching from egg masses which escaped the scouting. Mr. McIntyre has informed me that very recently an egg mass has been found in the town of Stowé, in the highest mountain region of the state. There has been some spread elsewhere.

I had hoped that there would be a chance, and I still hope there may be a chance, of the spread westward stopping, not on account of the cold or a control situation such as cited by Dr. Felt, but on account of the mountain region. There is a strip of territory down through the mountain region of the state which is conspicuous on the highway map by the absence of roads; a strip perhaps 15 miles wide. Our growth being hard wood, I had hoped we should have at least a temporary halting of the spread of the insect through there. It remains to be seen whether we find any across there. If it does go across, unfortunately conditions are more favorable on the western side of the state than on the eastern side. We have gray birch, more oak and open country, more apple trees. I think our best efforts in Vermont are to be put forth east of the main mountain range.

COMMISSIONER PYRKE: How grave do you consider the menace in your state?

MR. BAILEY: Serious, but less so than in Massachusetts or probably in your state, for the reason that I have pointed out.

DISCUSSION

DR. W. E. BRITTON

Connecticut State Entomologist, New Haven, Conn.

Mr. Commissioner and Gentlemen: I will take only a few minutes to explain that the gipsy moth was first found in Connecticut, at Stonington, on the Sound, in 1906. That seemed to be an isolated infestation and the state appropriated some money and we went at it with the idea of exterminating it. That was done, and in 1909 another colony was found at Wallingford. Similar measures were taken there and that colony was entirely exterminated. Soon after the Stonington colony was exterminated, the outside edge of the general infestation reached Connecticut, and we found Thompson infested, and a little later the pest appeared again at Stonington. So, for nearly ten years we have been fighting to hold it back, knowing that it was impossible to exterminate it and keep it out of Connecticut when the adjoining states were infested.

We have had splendid cooperation between our state and the Federal Bureau of Entomology, and as has been said, the state has been handling it in those towns known to be infested, while the Bureau has spent more of its efforts along the border. And if we have an occasional wind spread which may take the gipsy caterpillars from the infested area and carry them several miles into the interior of the state, it does not mean that the Federal Bureau has not been doing good work. That is a thing that cannot be forecast.

We have had in Connecticut a great many of these parasites which have been mentioned. There has never been any stripping of the woodlands in Connecticut. This, I think, is due chiefly to the suppressive work done there. We have a law there similar to that in Massachusetts whereby we can compel towns to handle the matter themselves, but up to this time we have found it better to keep the work wholly in the hands of the state, which has trained men at work on it. It may come to the point where the towns will have to do it. We have been deferring that time until there is too much territory to cover with the state appropriation, or until the legislature refuses to grant appropriations, then we may ask the towns to control it. We have felt that it was worth while to hold it back as long as possible. A year ago we had something like thirty towns infested. Now, on account of the wind spread, this area has increased, so that something like ninety towns are infested, mostly very scatteringly infested. It is rather difficult to know just what our policy should be for the future. We expect to ask our legislature to give us an appropriation of \$100,000 for the next two years, where our present appropriation was only \$60,000 for two years. We also expect to use up our present appropriation before the end of the present fiscal year, and we will probably ask for a deficiency appropriation of \$20,000 to tide over

that period. We believe, however, and we have some reason for believing, that in time there will come a balance so that it will not be necessary to spend as much money in each town as we have been doing, but we think if we can keep this work up a few years longer, it will give the natural agencies a better chance to reach that point whereby the balance can be established.

Of course, the state of Connecticut is covered with gray birch, oak, and apple trees. We have some forest areas and extensive brush areas. There are also a great many orchards, so it is a rather difficult country for controlling the pest and we have been depending chiefly on creosoting egg masses and on spraying.

I know that we should be glad to have some definite policy adopted like what has been mentioned here, but I do not see any way of preventing this occasional wind spread.

We were somewhat at a loss in Connecticut to know just where the caterpillars came from, because a year ago our nearest infested point in Connecticut was much farther away from some infestations recently found, than infested places in Massachusetts, yet we could not explain how the winds could carry it so far from Massachusetts. We have not been able to find other infestations in Connecticut from which it might have spread. If any dead line is adopted, like the Hudson River, for instance, or any strip this side of the Hudson River, very careful work will have to be done on both sides of that line, and the danger of wind spread will be very much greater if any high elevations immediately to the east of it are allowed to become thickly infested. I think that where this work has been done and the numbers kept down to the minimum, the chances for an extensive spread are very much less than if the insect is allowed to multiply unchecked.

COMMISSIONER PYRKE: In your state is the problem becoming more or less intense, in your opinion?

DR. BRITTON: It would be more intense except for the work we have done. It is now more extensive because of wind spread.

COMMISSIONER PYRKE: Do you feel optimistic?

DR. BRITTON: I think the natural measures seem to be on the increase rather than on the decrease, and I should feel optimistic over our artificial measures except for the largely increased territory we have to cover. We have been up against the same problem as Mr. Burgess, the difficulty of getting and holding trained men. With business conditions improving and higher prices paid help, it will be very difficult to hold any kind of men, and there have been times when, even if we had an unlimited amount of money, we would not have been able to obtain the right kind of men for the work.

DR. MARLATT: Do I understand that your work extends through the entire state and that you attempt to clean up all infestations as they are found?

DR. BRITTON: Yes, except what the Federal Bureau of Entomology does.

DR. E. P. FELT: Dr. Britton, may I inquire whether you consider this expenditure of money, nearly one thousand dollars per town in your state, good business?

DR. BRITTON: Yes, sir, we do.

COMMISSIONER PYRKE: The last of the New England states is represented here by R. A. Sheals, Assistant State Entomologist of Rhode Island.

DISCUSSION

R. A. SHEALS

Assistant State Entomologist of Rhode Island, Providence, R. I.

I believe the gipsy moth is present in every town in the state of Rhode Island. We have the most serious infestation in the north-eastern corner. Three years ago we had hundreds of acres of woodland stripped as completely as those in photographs shown. We sprayed three years ago through there, aided by the federal people. At the present time in that same area we have no defoliation at all. I believe in that section parasitism by insects has reduced the hatch at least 40 to 60 per cent, and the same condition holds true to a lesser degree throughout the state. Our policy in the future will probably be to take care of the trees along the roadsides and of ornamental trees in the cities. I don't believe Rhode Island will ever do any general spraying, unless the pest becomes very numerous.

COMMISSIONER PYRKE: Are you optimistic or pessimistic?

MR. SHEALS: I hate to hazard a guess, because I am not so certain whether when the pest decreases, the parasites may decrease and the gipsy moth may come back to the same extent as before. I would be optimistic, I might say, of conditions at the present time; if they continue we would be very optimistic down there. I think perhaps we will have a reinfestation there.

DR. MARLATT: Do you think the disappearance of the pest from this badly infested area was due to spraying or natural causes?

MR. SHEALS: Natural causes.

Commissioner Pyrke at this time introduced Dr. T. J. Headlee.

DISCUSSION

DR. T. J. HEADLEE

New Jersey State Entomologist, New Brunswick, N. J.

Mr. Chairman and Gentlemen: Our problem with the gipsy moth is being handled entirely as a cooperative matter between the New Jersey State Department of Agriculture and the Federal Bureau of Entomology. When the infestation was discovered and it became clear that the state must do something looking toward its possible extermination, the Department of Agriculture requested Mr. Burgess to designate some member of his field force

for fighting gipsy moth as a head for the gipsy moth exterminative effort in New Jersey. He designated Mr. H. A. Ames as the proper man to carry out the work of this project under the general direction of Mr. H. L. McIntyre, chief of the field workers on gipsy moth for the Federal Bureau of Entomology.

For the first year the state made an emergency appropriation of \$112,000 which Mr. Ames and the organization under him expended. In addition to this appropriation Mr. Ames expended the sum of \$117,784.82 of Federal Bureau funds and \$25,000 contributed by Mr. James B. Duke, making a total of \$254,784.82. The second year the state appropriated \$125,000, which, together with \$101,500 * of Federal Bureau funds, were expended. For the third year New Jersey appropriated another \$125,000, and on this fund, supplemented by Federal Bureau funds, work is now going forward.

Almost from the outset, in addition to the work going on within and adjacent to the infested areas, a separate organization of a half dozen or more men was instituted for the purpose of scouting the state at large to uncover any hitherto undiscovered infestation and to examine incoming nursery stock for possible infestation by gipsy moth. This organization is under the immediate direction of the Chief of the Bureau of Statistics and Inspection of the New Jersey State Department of Agriculture.

In the first year, during the dormant season, approximately eight hundred square miles were scouted and about 3,003,065 egg masses of the gipsy moth were found, of which about 3,000,000 were discovered in the original center of infestation in Dukes Park near Somerville, New Jersey. These egg masses were scattered over an area of approximately five hundred square miles and in ten small outlying infestations. The scout of the second dormant season showed a total of 844 egg masses, of which 51 were found in the original center of infestation in Dukes Park, near Somerville, and the balance, with the exception of 10, within the 500-square-mile area above mentioned. The excepted number of 10 was found in the largest outlying infestation located at Mendham. All outlying infestations other than the one at Mendham were apparently exterminated by the first year's work.

The findings under burlap bands during the summer just passed showed 1005 larvae and 114 pupae. The dormant season scout of the present year has probably not covered more than about one-eighth of the area. These results have not as yet been correlated.

With this record behind us it looks as if the gipsy moth infestation might be exterminated and consequently we feel considerably encouraged.

The problem of holding the gipsy moth along such a line as has been mentioned here this morning is a matter of extreme importance to us; because, if the gipsy moth is not thus held, although

* This does not include about \$15,000 spent in training men in New England for work in New Jersey.

we may exterminate it from New Jersey, it will sooner or later roll in upon us as an extension of the large infested area which is at present limited to New England. Our exterminative effort in New Jersey no doubt appeals to you as an extremely important effort because if we do not exterminate it in that state the establishment and maintenance of such a line would in the long run be practically useless because of the movement of our infestation into territories entirely west and south of that line.

I hold that the expenditure of public funds in the effort to prevent the spread and to exterminate the gipsy moth is entirely justified from a business standpoint because: (1) every year of delay means the putting off of the time when the annual expenditure for control alone will be many times that which we are now expending over a period of a half dozen years or more to prevent movement and to exterminate; (2) the chance for preventing spread and for extermination of infestations beyond the holding line seem full of promise.

New Jersey has every reason to favor a well considered movement to establish a line beyond which the great New England infestation shall not proceed either west or south and to exterminate all infestations occurring either west or south of that line, and I think I can assure you of such support as she is able to give to any well considered movement looking toward this end.

COMMISSIONER PYRKE: Is the situation in New Jersey disturbing, as you see it?

DR. HEADLEE: The situation in New Jersey is sufficiently disturbing to make our people support large appropriations in the hope of exterminating the gipsy moth within our borders. The data which I have submitted indicates that good progress in the direction of extermination is being made, and I think I can say that such of our citizens as understand the problem are very much encouraged with the progress.

COMMISSIONER PYRKE: This problem that we have been considering has been regarded as a national one. I suspect it may be international. Certainly, there is an international aspect to this conference from the fact that our neighbor on the north, the Dominion of Canada, is represented here. We shall be glad to hear from Mr. Leonard S. McLaine, of the Department of Agriculture, Ottawa, Canada.

DISCUSSION

LEONARD S. McLAINE

Chief, Division of Foreign Pest Supervision, Department of Agriculture,
Ottawa, Canada.

Mr. Commissioner and Gentlemen: We are very pleased to have the privilege of attending this meeting today and wish to express our thanks for the courtesy you extended in inviting us to be present. The Dominion Entomological Branch is represented by Dr. Swaine, Chief of the Division of Forest Insects, and my-

self. I also wish to extend the regrets of the Dominion Entomologist, Mr. Arthur Gibson, who, unfortunately, was unable to attend.

Canada is vitally interested in the gipsy moth problem and has been for a number of years, especially since the brown-tail moth invaded the Maritime Provinces, the invasion being due to a flight of moths from the neighboring New England States. In 1910 with the assistance and cooperation of Dr. Howard and Dr. Burgess, the Dominion Department of Agriculture began rearing parasites of the brown tail and gipsy moths at the Melrose Highlands Laboratory, Massachusetts. The parasites were liberated in the Maritime Provinces and also in the eastern townships of Quebec.

To illustrate that Canada is vitally interested in this gipsy moth problem, I will refer to what happened last year. Two rumors were received to the effect that the gipsy moth was seen at one point in Nova Scotia and another in New Brunswick. Arrangements were made immediately for the examination of both these districts; one area in particular was scouted three times, and I am very thankful to say that no sign of this insect was found in either district. This past summer we received a rumor to the effect that the gipsy moth was found in a shipment of nursery stock originating in a nursery in the Middle West. Steps were taken to trace all importations of nursery stock entering Canada from this nursery and the nurseries or other premises receiving shipments from the nursery concerned were carefully and thoroughly inspected, but we were unable to locate any sign of the pest. From recent information it appears to be that the rumor was unfounded.

In examining the maps on the walls, showing the present distribution of the gipsy moth, it will be noted that there are two regions that we concede are danger points as far as Canada is concerned. The first is New Brunswick, from southeastern Maine and the second is the Quebec border. Two years ago Mr. McIntyre and myself visited the eastern townships of Quebec with a view of determining the possibilities of gipsy moth infestation and means of control which would have to be adopted. After making this trip we were of the opinion that if the gipsy moth invaded this area Canada would be faced with a very serious problem, if climate and other factors did not play an important part in the control of this insect. Fortunately, there is a natural barrier along the international boundary, consisting of a height of land which extends approximately along the boundary. This barrier so far has no doubt retarded to some extent the northern spread of the gipsy moth, and it is to be hoped that the pest will not surmount the barrier and get into the territory on the northern side. On the Quebec side of the boundary the St. Lawrence watershed commences and the land slopes away to the St. Lawrence River, giving ample opportunity for wind spread.

In addition, this is a large apple producing country, particularly in Chateaugay County. If, as Mr. Burgess has stated, there

is a possibility that the natural northern limit of the gipsy moth is dependent upon the apple, I feel that the insect will invade and damage a large amount of Canadian territory, for the Quebec Government has established at a point just south of the city of Quebec, a provincial nursery for the growing of apple and other fruit trees which are generally distributed throughout the apple growing sections of the province.

Professor Herrick has asked the question, as to what Canada would do when the gipsy moth invaded her territory. It is impossible for us to answer this at the present time, as the problem does not yet confront us; but Canada is seriously and vitally concerned with this problem. She realizes that insects recognize no international boundaries. I can safely say, however, that when the problem does confront us you may be assured that you will have our earnest cooperation.

COMMISSIONER PYRKE: Canada has demonstrated now, as in the past, that she is alert in all these problems. It seems to me that the proportions of this problem have been placed before us today with unusual intelligence and clarity. Before we take up questions of policy, for the benefit of those who do not live in this state, something should be said about our timber resources and about our public reserves, concerning which we are so much interested. In this state our forestry matters are under the jurisdiction of the Conservation Commission. I wonder if Superintendent Pettis will not tell us something about our reserves which may be menaced by this pest.

DISCUSSION

C. R. PETTIS

State Superintendent of Forests, Albany, N. Y.

Mr. Chairman and Gentlemen: I do not feel that I am able to give you much information of value in regard to the gipsy moth. I came to this meeting for the purpose of learning. The spread of the gipsy moth to the forests of New York is a problem in which the Conservation Commission is vitally interested. Reference has already been made by some of the speakers to our state parks.

We have many of these, the largest of which are the Adirondack and Catskill Parks, where the state owns approximately 2,000,000 acres of land. The forests in these parks contain but little oak or gray birch. They are composed of 70 per cent or more of hard wood, in which beech, birch, and maple predominate, together with some spruce, hemlock, pine, and balsam. The next largest state park is the one in the Palisades. This is probably the largest recreation field in America. This park, which is intensely used, affords a great public benefit. In the Palisades Park there is a large percentage of oak and birch, forest trees which I understand are preferred food of the gipsy moth. There-

fore, the problem in the Palisades Park seems even worse than in the Adirondack or Catskills.

Dr. Felt has suggested the possibility of a zone where efforts are to be combined, to which we say the gipsy moth must not cross. I think it would be possible to find a succession of cleared land, extending up through the Harlem Valley, easterly of the scrub oak growth in the lower Hudson and then up through the Hudson Valley and extending on to Lake Champlain, where such a zone would be practicable. In some places it would not be a difficult matter to have an area in which the favored food plants of this insect might be eliminated, and in my opinion, within a comparatively small distance. In some of these cleared lands, there are, of course, large fruit orchards to be found.

The state of New York has about twelve million acres out of thirty million acres which are either actual or potential forest lands and we cannot afford to let something come in which will depreciate the value of 40 per cent of our state. Something must be done, but I do not think we should go at this thing blindly and ask for a large appropriation on an experimental basis; we have been brought together today to find out what was the thing in New York for us to do. There has been as yet practically no appropriation in New York for the gipsy and brown-tail moth, although we are spending about \$50,000 a year on blister rust. It seems to me that before this meeting closes there should be some sort of a plan devised and recommendations made which can be taken before our Board of Estimate and Control. Mr. Graves, of the Board of Estimate and Control, was invited to come to this meeting, and promised to do so, but apparently something has detained him. We need a constructive proposition to present to our legislature. If smaller states can appropriate \$100,000 a year, I don't see why New York cannot do what is necessary. We must have an appropriation which we know we can use to advantage in a practical way for scouting in the most dangerous places and see what the distribution is, and make some determination as to whether a zone of this kind can be built, and how we are going to do it.

COMMISSIONER PYRKE: The disease under consideration has been very carefully and completely diagnosed. The second phase for our discussion is that of the remedy to be applied. We should have the combined wisdom of this group on the problem. So far as New York State is concerned, our legislature will meet in about six weeks, and if anything is to be done the preliminary steps should be taken without delay. The question has both a state and an interstate phase, and I think we should hear something from Dr. Marlatt, Chairman of the Federal Horticultural Board, as to the policy that should be pursued, both from the state and the interstate standpoint.

DISCUSSION

DR. C. L. MARLATT

Chairman, Federal Horticultural Board, Washington, D. C.

I take it that we are here as a group of experts who already know the subject and know what is being done, and it is not necessary to waste time telling what we all know.

The quarantine work to control the interstate spread of these two pests, the gipsy and the brown-tail moths, is something that has been going on for many years, and we are all familiar with it. We think it is perhaps the most valuable work done, from the national standpoint. Its object is national, to prevent spread interstate by long jumps. That it has been successful, at least so far as our present knowledge goes, the history of these pests fully demonstrates. There have not been any long jumps that have not been determined and controlled. The invasion of New Jersey, of course, is an entirely different matter. It did not come from New England. The quarantine work being carried out under the direction of Mr. Burgess, and the Federal work in cooperation with all these states, has demonstrated its value, I think, fully, and that work should be continued. There is no question about it.

This plan you are discussing now of establishing a defense line is in my judgment a very good one. I think it is worth the time. I agree with Mr. Headlee that the cost will be only a small fraction of the benefit to be gained in retarding the spread.

I might say a word on spread. Spread is bound to follow. You can't stop the spread of a pest of this kind, you can only retard it. At best, it is bound to go over the country. It is like a prairie fire, it goes fastest in the direction of the wind. There are certain agencies which prevent it from going rapidly westward and southward. The ultimate spread of the thing is bound to follow, the natural spread, the spread of the insect by wind and by local carriers. The quarantine work of the government, if it will stop long distance spread, I think is fully justified and should be supported. I think any quarantine work of that kind which involves the safeguarding of the movement of products and of persons—chiefly of products—as in automobiles, is something that must be done adequately. There is not much use half doing it. You should have funds enough to do it adequately. All of the dangerous material that moves should be inspected, and appropriations should be sufficient for that purpose. To do only a portion of the work is largely to waste your effort and money.

I hope the impression was not gained from any questions I asked that I wished to minimize in any way the importance of this pest as a forest pest in this country. It was simply to bring out a little more clearly the natural control which we all hope will eventually be the main factor in controlling this pest. Such natural control is beginning to work, as I think has been

thoroughly shown. However, it has not been shown, I think, to be of sufficient value to warrant letting down the bars in any place. But I think in this group we want to know not only the worst but the best, and it was for that reason I asked these questions about natural control. Naturally, all of these things are of great interest. The outbreak in Rhode Island was severe, but there was some control, probably natural, which reduced the outbreak the next year.

The history of the insect, as I recall it, both in this country and in Europe is that it is more or less a pest of periodic outbreaks. It does not cover and devastate whole districts year after year. New England, although infested for many years, has never been absolutely devastated as a whole. It has been spotted, and a few acres or a few hundred acres defoliated, but the number of these spots some years has been very great and other years less. The insect gets a start in some spot and this results in stripping, varying from year to year. That is the general nature of the insect.

This brings up one point, namely, whether the parasitic control is not going to be increased by these outbreaks in spots. They furnish an enormous amount of food for the parasites and general control throughout the whole district may come about from the overflow from the spots.

COMMISSIONER PYRKE: Dr. Howard, we have not been favored very much from you up to the present time. I wonder if it would not be proper for you to say a word to us on the question of this so-called "Hindenburg line," as to its wisdom.

DR. L. O. HOWARD: I am very much impressed with the idea. While you are working to maintain that line, we will, of course, work in cooperation with you. I am very sure we can work with New York as we are working with New Jersey. I think this undoubtedly is the best idea in sight.

COMMISSIONER PYRKE: I think the meeting should now be on an absolutely open basis. We will hear anyone who has suggestions to offer.

DR. BRITTON: Mr. Burgess knows how we are carrying on the work in Connecticut. The parasites have a much better chance where the infestation is intense. What proportion of the parasites do we kill by treating with creosote?

MR. BURGESS: The trouble in discussing parasites, is that you have to discuss every species individually. With the two species of egg parasites, we have one species that is single-brooded and lives in the eggs during the winter; another species is two- and sometimes three-brooded, and winters outside the eggs. The single-brooded species will survive fairly far north, while the double- and triple-brooded species, very seldom survives during a cold winter north of Boston. If you creosote egg masses that contain the overwintering parasites, you kill the parasites. In every egg mass you creosote you destroy a larger proportion of eggs than the

parasite would destroy, because the parasite never attacks 100 per cent of the eggs — 40 to 45 per cent is usually the limit. We found years ago in connection with this particular parasite, that it would find and attack egg clusters that were not found by men sent out to make collections. I don't feel you are losing a great deal, as a general proposition, in creosoting egg clusters, even though you have parasites established. If you creosote after the middle of December, you will kill none of the other species. So far as the parasites of the caterpillars are concerned, it depends on the particular species.

DR. C. L. MARLATT: Would it be possible to substitute some other method for creosoting?

MR. BURGESS: You scatter too many eggs.

DR. FELT: I think most of us are well convinced that New York State should take some steps to protect itself and thus assist materially in protecting the rest of the country. Most of us know that this work can be done well only by men who have had experience. I think we will agree with Mr. Burgess that one of the first things to find out is the exact condition of our eastern border adjacent to the infested territory. Mr. Burgess has prepared some estimates, which show that it would cost about \$100,000 adequately to scout New York territory directly west of the present infested area. The experience of New Jersey working in cooperation with the Federal Government and the attitude of those gathered here leads me to suggest that the state of New York should appropriate this year enough money for thorough scouting and cleaning up of whatever may be found on our side of the line. Such scouting and cleaning up would be the first and most natural step in the establishment of an effective barrier zone. If it developed that there were infestations at but a few points, a similar program for another year might meet every requirement. There should also be a careful examination of the Hudson and Champlain valleys in particular for the purpose of ascertaining the most favorable location for this barrier zone, the actual establishment of which would be conditioned on the insect's spread to the selected area. There should be adequate funds available whenever needed. Inadequate appropriations would simply defeat the project. The establishment of such a barrier zone would not necessarily mean its permanent maintenance, since it would be easy to modify methods if conditions justified a change.

COMMISSIONER PYRKE: Personally, I find myself almost completely in agreement with the views expressed. We ought not to lose the opportunity of getting all the knowledge we can on the subject from the experts representing the various states and countries, as well as suggestions from them. While we are on this phase of the matter — this matter of tactics — I think we might be benefited in hearing from Dr. Ball. He was introduced to me as the man who wielded the blue pencil.

DISCUSSION

DR. E. D. BALL

Director of Scientific Work, U. S. Department of Agriculture, Washington, D. C.

I am very much interested in Dr. Felt's suggestion. I believe he has looked at the thing in a big way and has outlined what ought to be a natural problem, provided we can eliminate the New Jersey infestation. All of my consideration of the gipsy moth situation is based on the possibility of eliminating the New Jersey infestation as a factor. I believe very thoroughly if we do not eradicate the gipsy moth in New Jersey, that we probably will have to abandon the fight some time in the future. If we can eliminate the gipsy moth from New Jersey, then I believe that your "Hindenburg line" is a feasible proposition. Secretary Wallace has expressed himself many times that in all of these matters, the state should contribute in proportion to the menace to the state. I feel sure that if we come to a question in regard to appropriations, the Secretary will want the state of New York to assume its fair share of the burden of responsibility.

COMMISSIONER PYRKE: Assuming an appropriation was made by the state legislature, would you think that the expending of that fund should be in the hands of the Federal Bureau, as Dr. Felt suggests?

DR. BALL: It does not make any difference as to that. If you agree on a cooperative basis and agree on some one to carry it out, it might be a Federal Government man or a state man. That is a matter of judgment. What you want is the best man. The money is wasted if you don't find the right man, who has faith in the project and ability to put it through.

COMMISSIONER PYRKE: The suggestion has been made that the work of the Federal Bureau has been curtailed by lack of funds. Is there anything this conference can do to strengthen the work of the Federal Bureau?

DR. BALL: I think that reference is to past conditions and not to present ones. Last year, we made a very strenuous fight to increase the gipsy moth appropriation, to meet this emergency, which resulted in the appropriation being left as recommended; and I have every faith that the appropriation will be allowed to stand again this year.

I do not quite agree with Dr. Marlatt on the idea that we must necessarily look forward to the gradual extension of this insect over the area of the United States. I think there is no question but that that will be true if we fail to control the New Jersey situation. On the other hand — and when I say this I am assuming that New Jersey is with the cooperation of the Federal Government going to eradicate that infestation there, for I was astonished in their wonderful accomplishment there in one year —

I am not willing to agree entirely with Dr. Felt on the "Hindenburg line" on the present basis of suggestion of that line. That line should be carefully surveyed as one on which the insect can be held with the greatest ease and the greatest security, and if some parts of that line are now overrun with the insect, we can duplicate the New Jersey tactics, and put them back. We have demonstrated in too many cases what the American spirit can do, if we go at it right. Just as has been suggested in the case of the brown-tail moth, there will be waves of extension and waves of recession of the gipsy moth, and if we can take advantage of the wave of recession, we can move them back.

COMMISSIONER PYRKE: You believe in this line as suggested by Dr. Felt, but believe it should be made elastic, movable?

DR. BALL: Yes, sir, movable back but not forward.

COMMISSIONER PYRKE: Is there anything further that should be said on this subject?

DR. MARLATT: We have a quarantine line now based on the actual known infestation by townships. It is not the purpose, I understand, to abandon that line, but to hold it. The history of the thing has been one of slow spread. That has been a regular thing in spite of every effort which the State and Federal governments have made. There is no use blinding ourselves to the possibility of spread. We are all willing to put our shoulder to the wheel and try to hold this while it is possible to do so.

RESOLUTIONS

Resolutions adopted by representatives of the United States and Canadian Departments of Agriculture, the New England States, New York, and New Jersey Departments of Agriculture, Conservation, Forestry, and Entomology, at Albany, November 16, 1922:

WHEREAS, The gipsy moth is one of the most destructive insect pests affecting forest, shade, fruit, and park trees; and enormous damage has been caused by this insect in New England; and upwards of twenty millions of dollars have been expended by these states and the Federal Government in their efforts at suppression and control, and,

WHEREAS, The spread of this insect constitutes a serious menace to the forest, shade, fruit, and park trees of New York State and the territory south and west thereof, and,

WHEREAS, It has been demonstrated that in local infestations, as in the case of New Jersey, complete eradication may be possible, and that over wide areas general control measures to reduce damage and injury are practicable, and,

WHEREAS, Owing to topographic features, distribution of different kinds of trees and feeding habits of the insect, it is believed

that a control zone should be established from Long Island Sound, in a general northerly course, east of the Hudson River, through New York or New England, or both, for the purpose of permanently preventing the spread of this insect, therefore, be it

Resolved, That it is the sense of this conference composed of foresters, agriculturists, entomologists and administrative officials, from the New England states, New York and New Jersey and representatives of the United States Department of Agriculture and the Dominion of Canada, held at Albany, N. Y., November 16, 1922,

That, sufficient appropriation should be obtained by the states interested, and the Federal Government for the purpose of continuing and strengthening present control methods in the infested areas, to eradicate the New Jersey infestation, to do necessary scouting for the discovery and destruction of border infestations, to determine the location of the most practicable place for a control zone, to take necessary steps to make control therein effective, and for the destruction of all infestations in and west of said zone.

MEMORANDUM REGARDING THE ESTABLISHMENT OF AN IMMUNE ZONE FOR STOPPING THE SPREAD OF THE GIPSY MOTH

It is suggested that a line of defense consisting of a twenty or twenty-five mile strip thoroughly scouted and kept clear of gipsy moth infestations, be located in the Hudson valley as a final line of defense to stop the westward spread of the gipsy moth. Information which we have regarding topography and forest cover, suggests the following as offering the most feasible location for such a line of defense. The center line of such a strip would pass through approximately the following points: Bedford, Golden Bridge, Brewster, Patterson, Poughquag, Mill Brook, Clinton Corners, Rhinebeck, Red Hook, Tivoli; thence following the Hudson river northerly to Fort Edward; thence following the Champlain Canal to Lake Champlain.

A glance at a forest map will show that such a line as suggested above will have to include considerable forest land in some sections, notably in Putnam and southern Dutchess counties, and at the extreme northerly end of the line in Washington County. It is believed, however, that the above location offers the most feasible route that can be found for such a line.

W. G. HOWARD.

Albany, N. Y., November 21, 1922.

CONFERENCE ON EUROPEAN CORN BORER

Resolutions adopted by representatives of the United States and Canadian Departments of Agriculture, the New England States, New York and New Jersey Departments of Agriculture, Conservation, Forestry and Entomology at Albany, November 16, 1922.

Resolutions

Resolved, That is is the sense of this conference, composed of foresters, agriculturists, entomologists, and administrative officials from the New England States, New York and New Jersey and representatives of the United States Department of Agriculture and the Dominion of Canada, held at Albany, New York, November 16, 1922;

That, we approve the efforts made by State, Federal and Canadian authorities to control the corn borer.

That, we express a deep concern at the marked increase in the seriousness of the infestation shown in certain areas,

That, we emphasize the need of practical methods of handling extensive weed infestations in suburban and market garden areas,

That, we believe every reasonable effort should be made to restrict the spread of this insect, and,

That, we express our great appreciation of the work of the Canadian authorities through detailed investigation and effective control in badly infested areas, and we particularly commend their hearty cooperation in facilitating the transfer of produce from Canada to the United States.



Fig. 1. Dead and defoliated woodland resulting from an attack of gipsy moth caterpillars.
(After U. S. D. A.)



Fig. 2. Band of sticky material. Note that the enormous numbers of gipsy moth caterpillars are below the band, but none are above it. (After U. S. D. A.)



Fig. 3. Applying tree-banding material to protect the foliage from gipsy moth caterpillars. (After U. S. D. A.)

